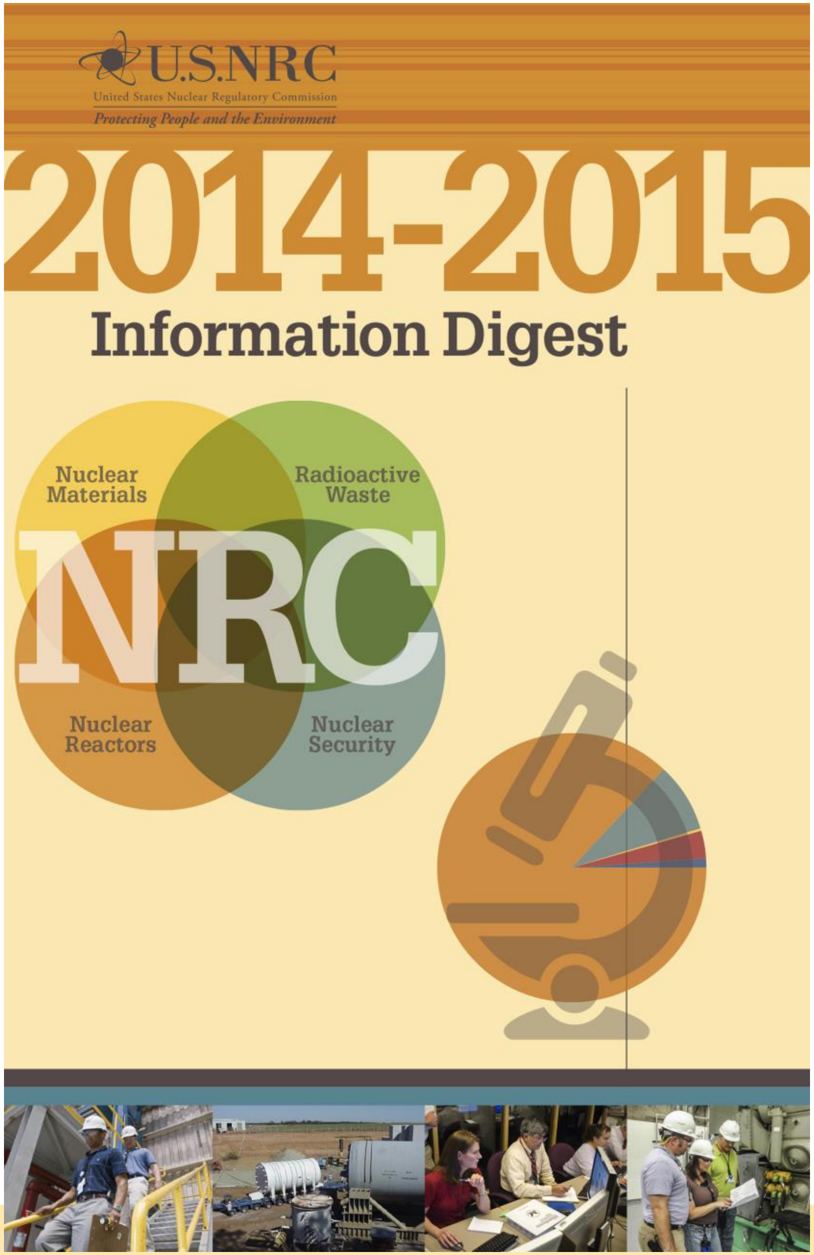
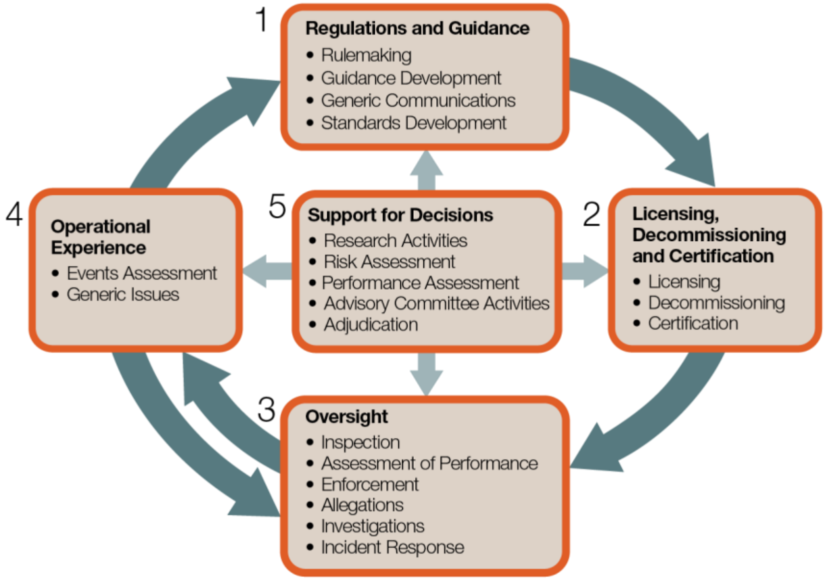
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

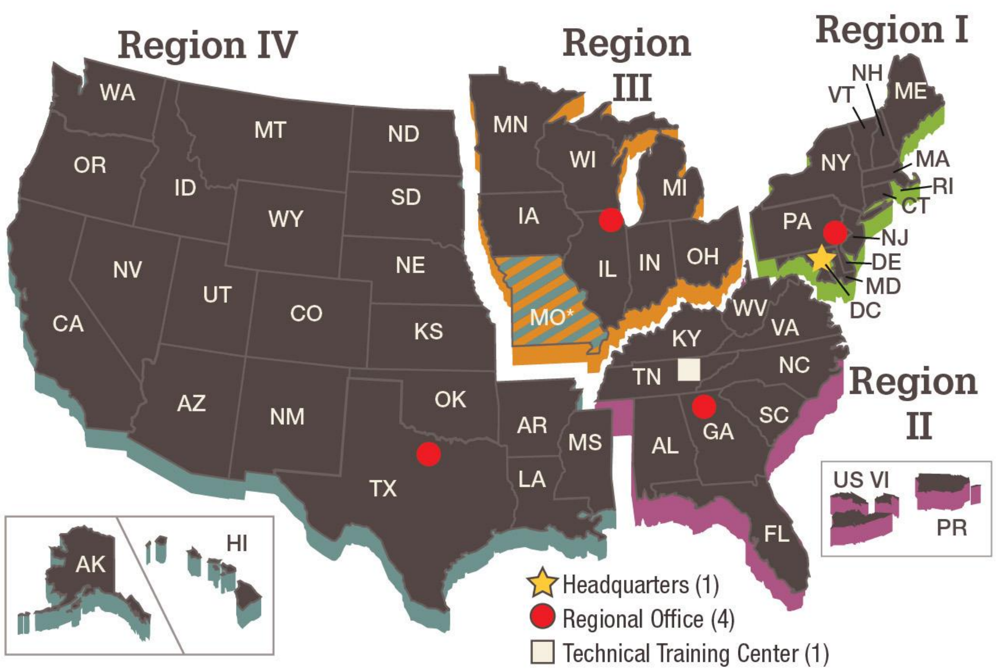


How We Regulate



1. *Developing regulations and guidance for applicants and licensees.*
2. *Licensing or certifying applicants to use nuclear materials, operate nuclear facilities, and decommission facilities.*
3. *Inspecting and assessing licensee operations and facilities to ensure licensees comply with NRC requirements, responding to incidents, investigating allegations of wrongdoing and taking appropriate followup or enforcement actions when necessary.*
4. *Evaluating operational experience of licensed facilities and activities.*
5. *Conducting research, holding hearings, and obtaining independent reviews to support regulatory decisions.*

NRC Regions



Nuclear Power Plants

- Each regional office oversees the plants in its region except for the Callaway plant in Missouri, which Region IV oversee.

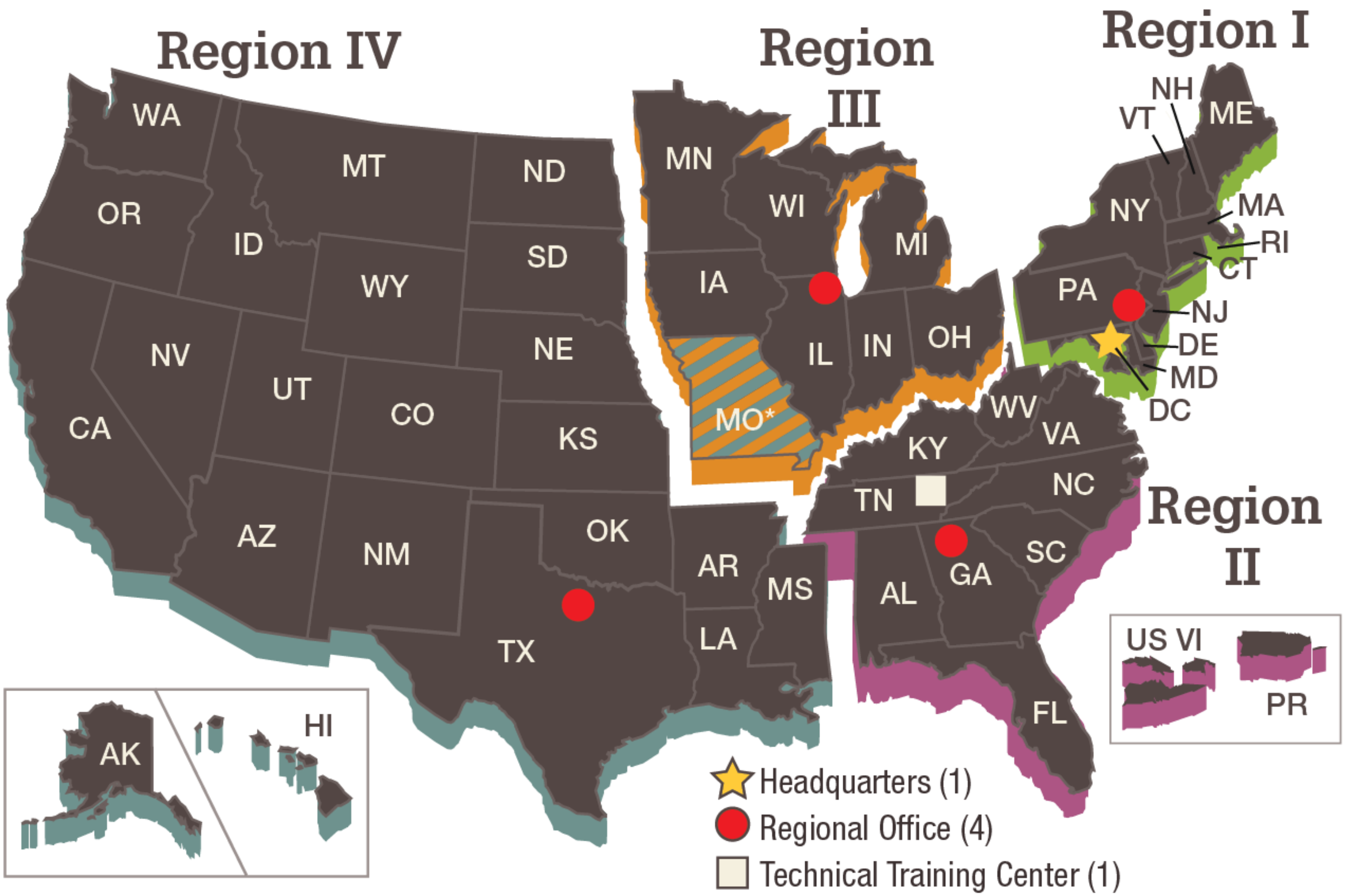
Materials Licensees

- Region I oversees licensees and Federal facilities located geographically in Region I and Region II.
- Region III oversees licensees and Federal facilities located geographically in Region III.
- Region IV oversees licensees and Federal facilities located geographically in Region IV.

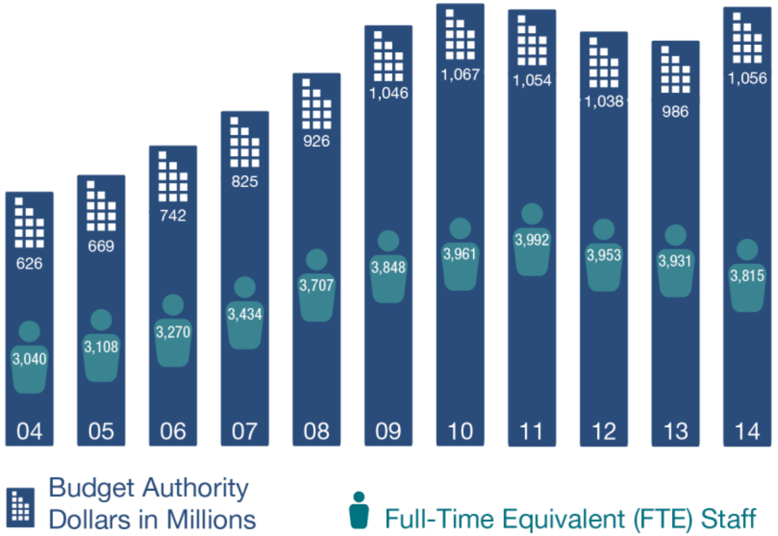
Nuclear Fuel Processing Facilities

- Region II oversees all the fuel processing facilities in the region and those in Illinois, New Mexico, and Washington.
- Region II also handles all construction inspectors' activities for new nuclear power plants and fuel cycle facilities in all regions.

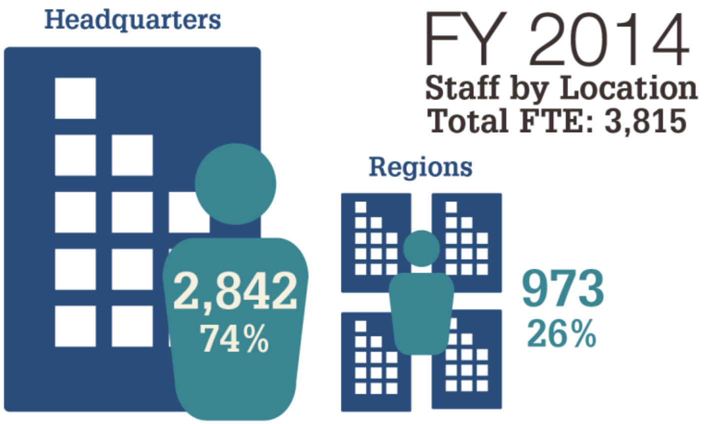
NRC Regions


Region IV
Region III
Region I
Region II
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO*
WI
IL
MI
IN
OH
AR
LA
MS
KY
TN
AL
GA
FL
SC
NC
VA
WV
NY
PA
VT
NH
ME
MA
RI
CT
NJ
DE
MD
DC
AK
HI
US VI
PR
Headquarters (1)
Regional Office (4)
Technical Training Center (1)

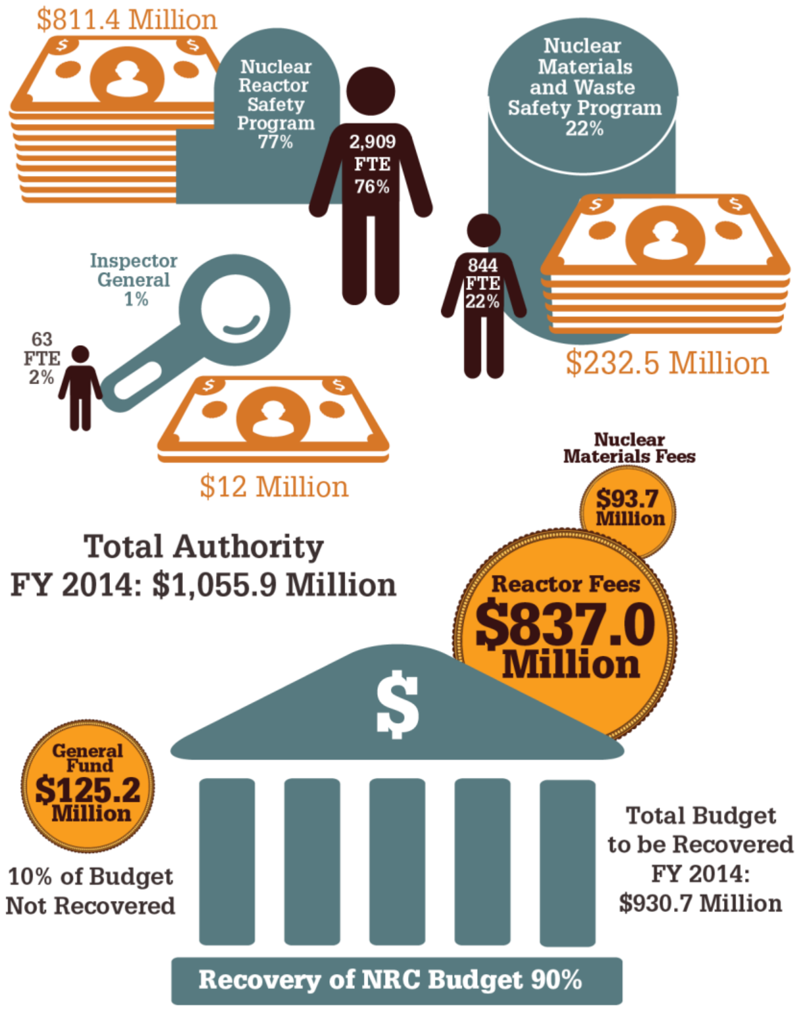
NRC Budget Authority and Personnel Ceiling, FYs 2004–2014



Note: Dollars are rounded to the nearest million.



NRC FY 2014 Distribution of Budget Authority and Staff; Recovery of NRC Budget



Note: The NRC incorporates corporate and administrative costs proportionately within programs.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Public Participation and Interaction

Public Meetings
Open
Closed

General Inquiries
Phone
Mail
E-mail
In Person

Information Meetings
Scoping
Preliminary
Counterpart
Information Exchanges

Education and Business Outreach
Minorities Groups
Small Business
Vendors/Contracts
Recruitment

Media Outreach
Press Conferences
Press Releases
Editiorial Boards
Interviews

Public Comments
Regulations.gov
Mail
E-mail
Fax
Verbally at Public Meetings

Resident Inspectors in the Community

10 CFR 2.206 Petition
Electronic or Hard Copy

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Web Site
www.nrc.gov

Adjudicatory Hearings

Advisory Committee Meetings

Public Document Room
Phone
E-mail
In Person

Conferences
International
Trade
Industry

Emergency Preparedness
Federal
State
Local

Social Media
Blog
Twitter
YouTube
Flickr
Facebook

Visitors to the Agency

Open Houses

Congressional Hearings

Allegations

Petitions for Rulemaking

Federal Register Notices

Bilateral Information Exchange and Cooperation Agreements with the NRC

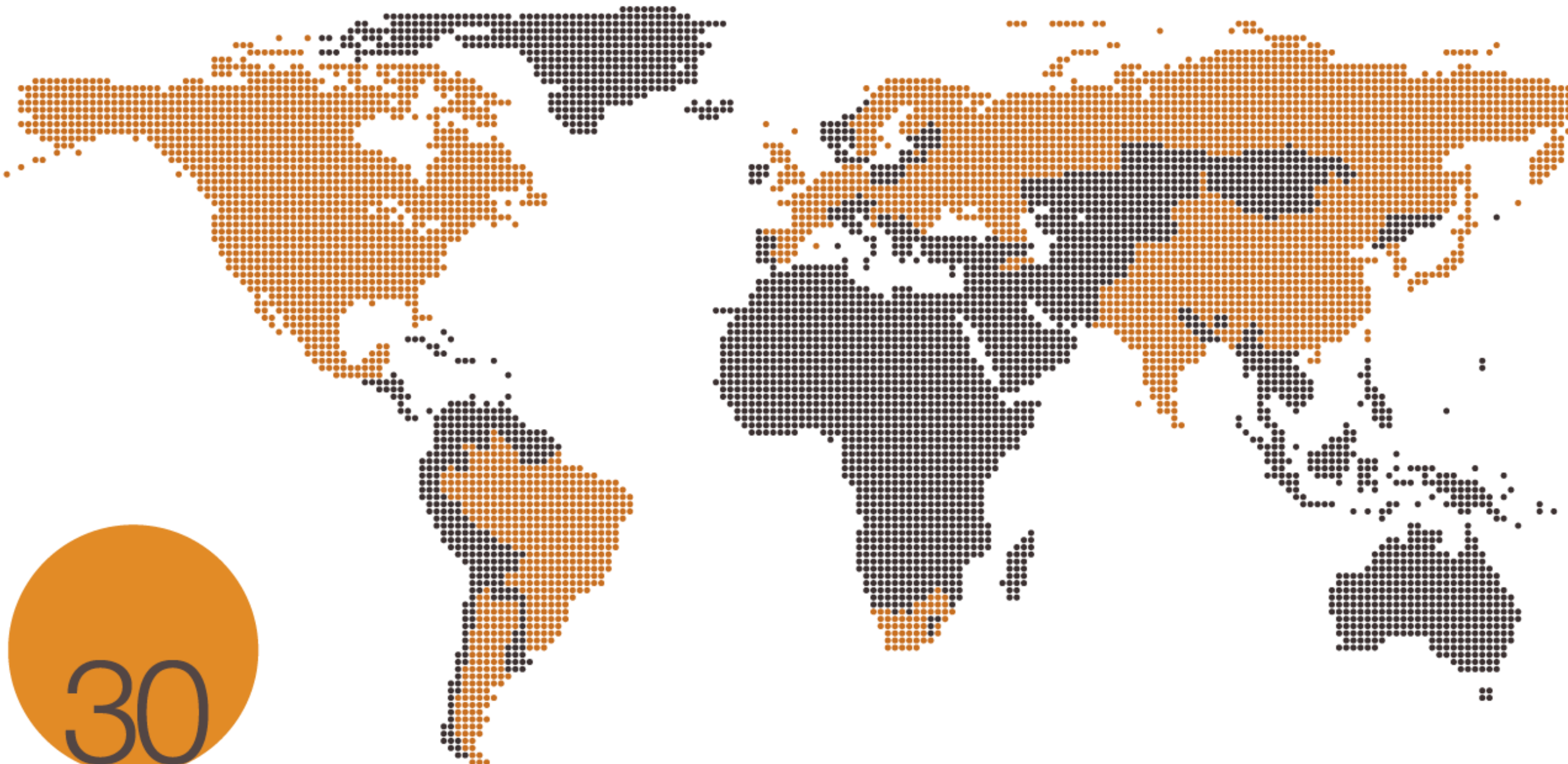
Agreement Country, Renewal Date		
Argentina, 2019	Greece, 2018	Poland, 2015
Armenia, 2017	Hungary, 2017	Romania, 2016
Australia, 2018	India, 2018	Russia,* 2001
Belgium, 2014	Indonesia, 2013	Slovakia, 2015
Brazil, 2014	Israel, 2016	Slovenia, 2016
Bulgaria, 2017	Italy, 2015	South Africa, 2014
Canada, 2017	Japan, 2015	Spain, 2015
China, 2018	Jordan, 2017	Sweden, 2016
Croatia, 2018	Kazakhstan, 2014	Switzerland, 2017
Czech Republic, 2014	Korea, Rep. of, 2017	Thailand, 2017
Egypt, 1991	Lithuania, 2015	Turkey, 2017
EURATOM, 2014	Mexico, 2017	Ukraine, 2016
Finland, 2016	Netherlands, 2018	United Arab Emirates, 2015
France, 2018	Peru, Open-Ended	United Kingdom, 2018
Germany, 2018	Philippines, Open-Ended	Vietnam, 2018

Note: The country's short-form name is used. The NRC also provides support to the American Institute in Taiwan. Egypt's agreement has been deferred until its regulatory body requests reinstatement.

EURATOM—The European Atomic Energy Community

* In negotiation

Operating Nuclear Power Plants Worldwide

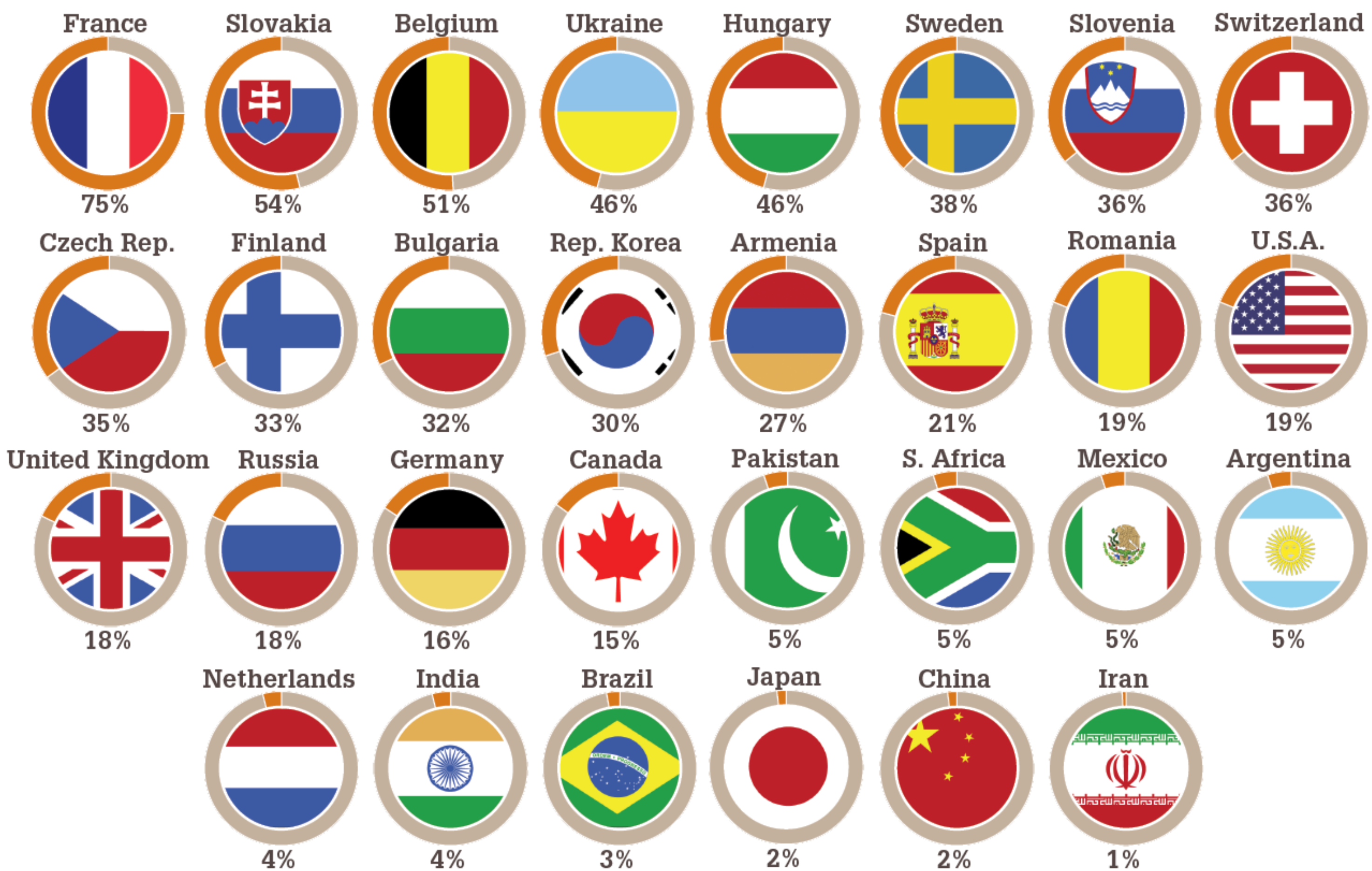


30 countries with 434 nuclear reactors

● Indicates a country with no nuclear reactors

Source: IAEA, Power Reactor Information System database, as of July 2013

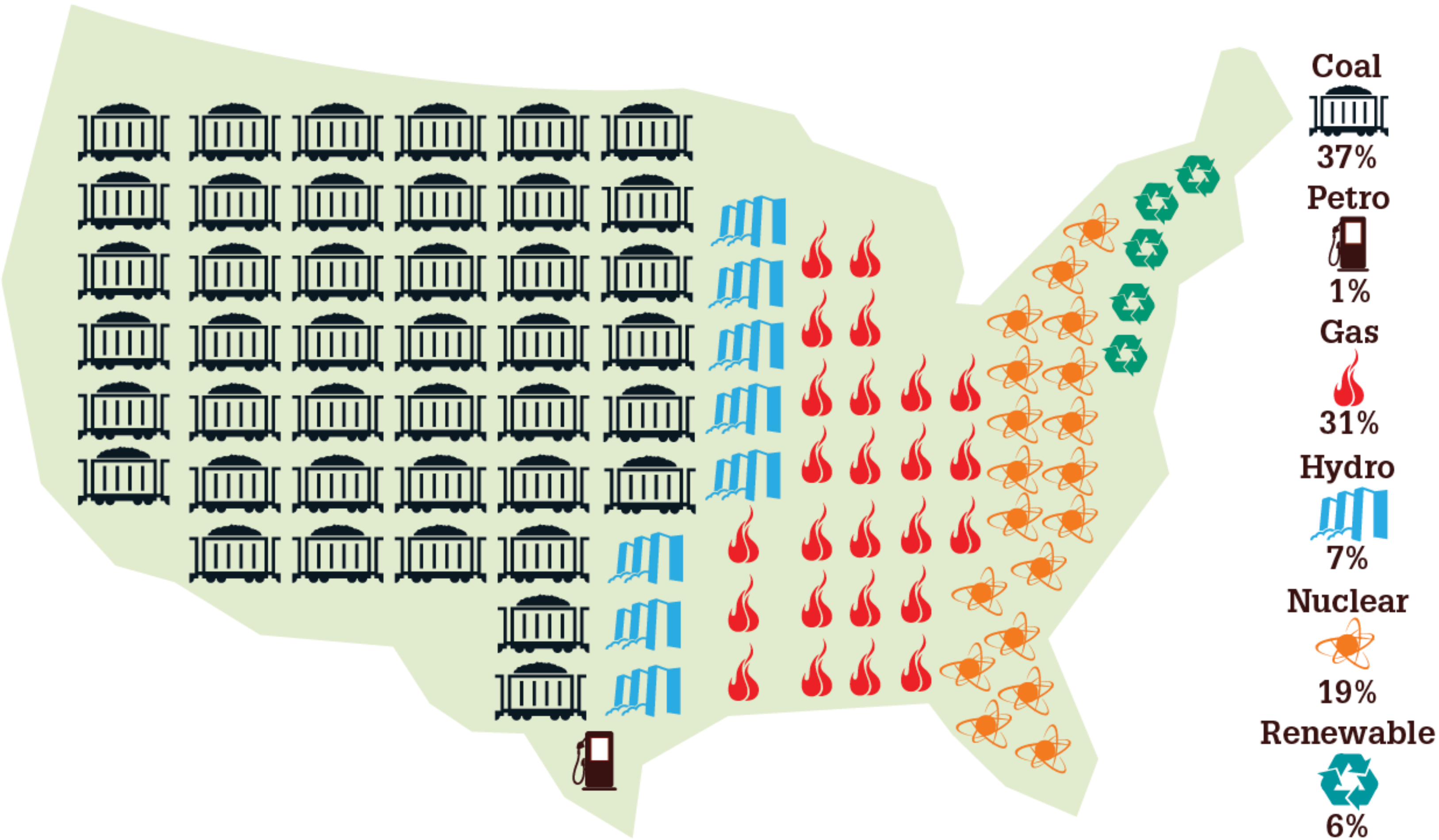
Nuclear Share of Electricity Generated by Country



Note: The country's short-form name is used.
Source: IAEA, Power Reactor Information System database, as of May 2013

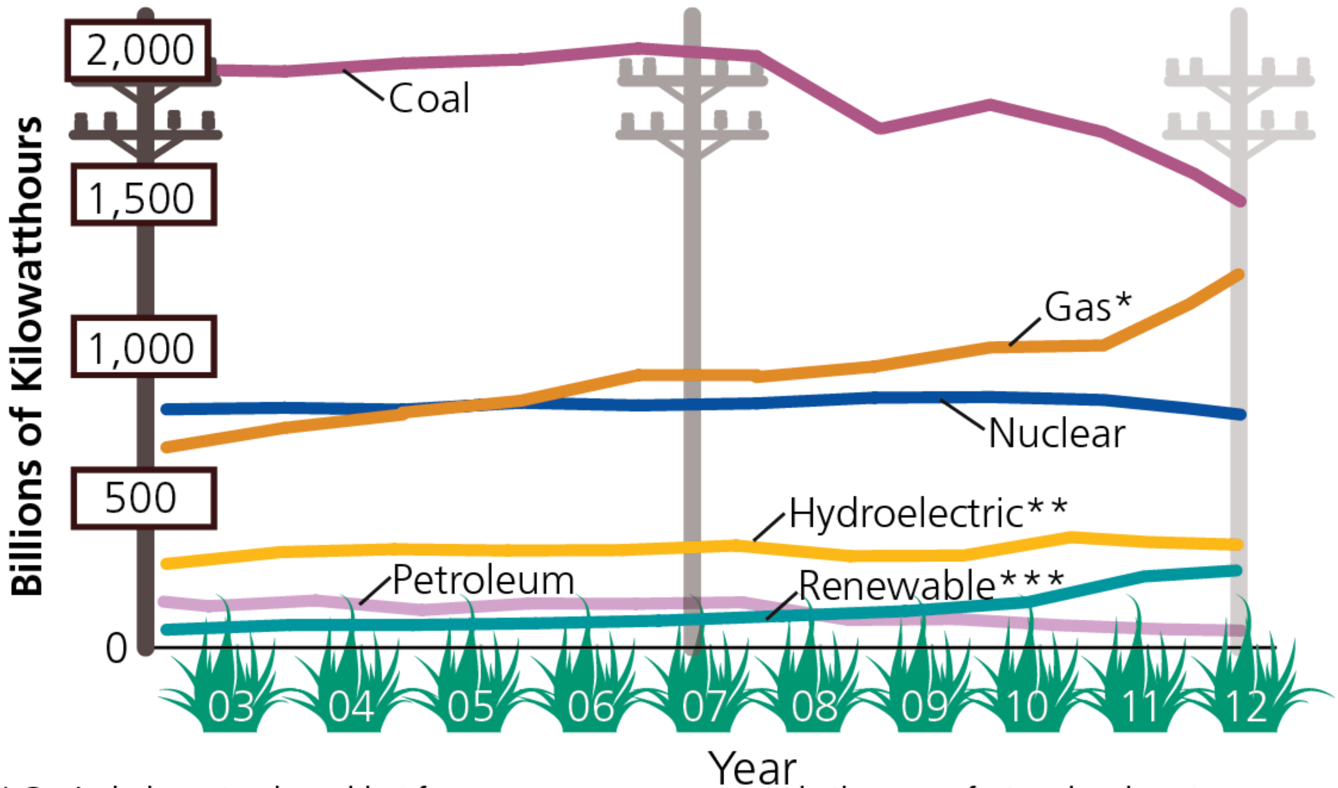
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

U.S. Net Electric Generation by Energy Source, 2012



Source: DOE/EIA, May 2013, www.eia.doe.gov Note: Figures are rounded to the nearest whole digit.

U.S. Net Electric Generation by Energy Source, 2003–2012



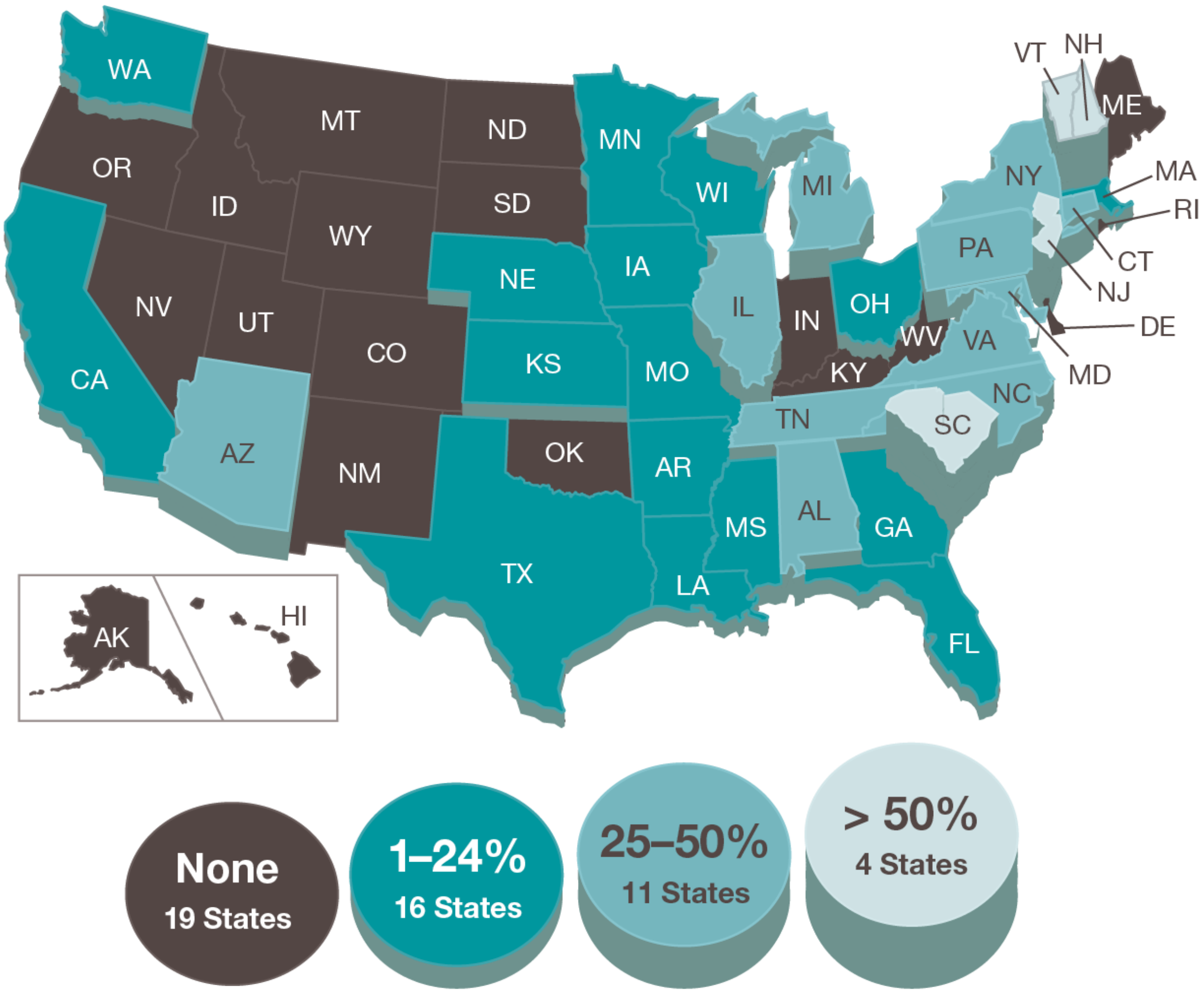
* Gas includes natural gas, blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuel.

** Hydroelectric includes conventional hydroelectric and hydroelectric pumped storage.

*** Renewable energy includes geothermal, wood and nonwood waste, wind, and solar energy.

Source: DOE/EIA, May 2013, www.eia.doe.gov

Net Electricity Generated in Each State by Nuclear Power



Source: DOE/EIA, "State Electricity Profiles," Data from May 2013, www.eia.doe.gov

Power Uprates: Past, Current, and Future

Uprates Completed 1977–2013:
7,034.9 MWe
Equal to about 7 Reactors

Uprates Under Review:
827 MWe

Projected Uprates 2014–2017:
1,097 MWe

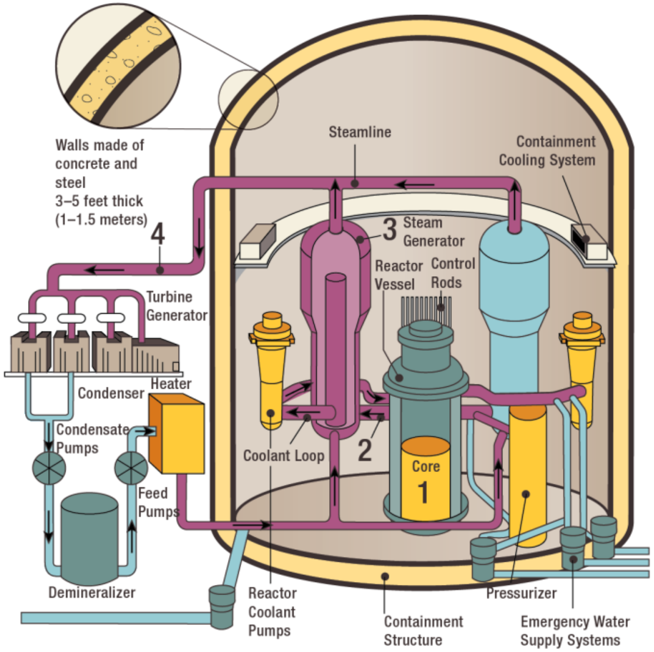
Typical Pressurized-Water Reactor

How Nuclear Reactors Work

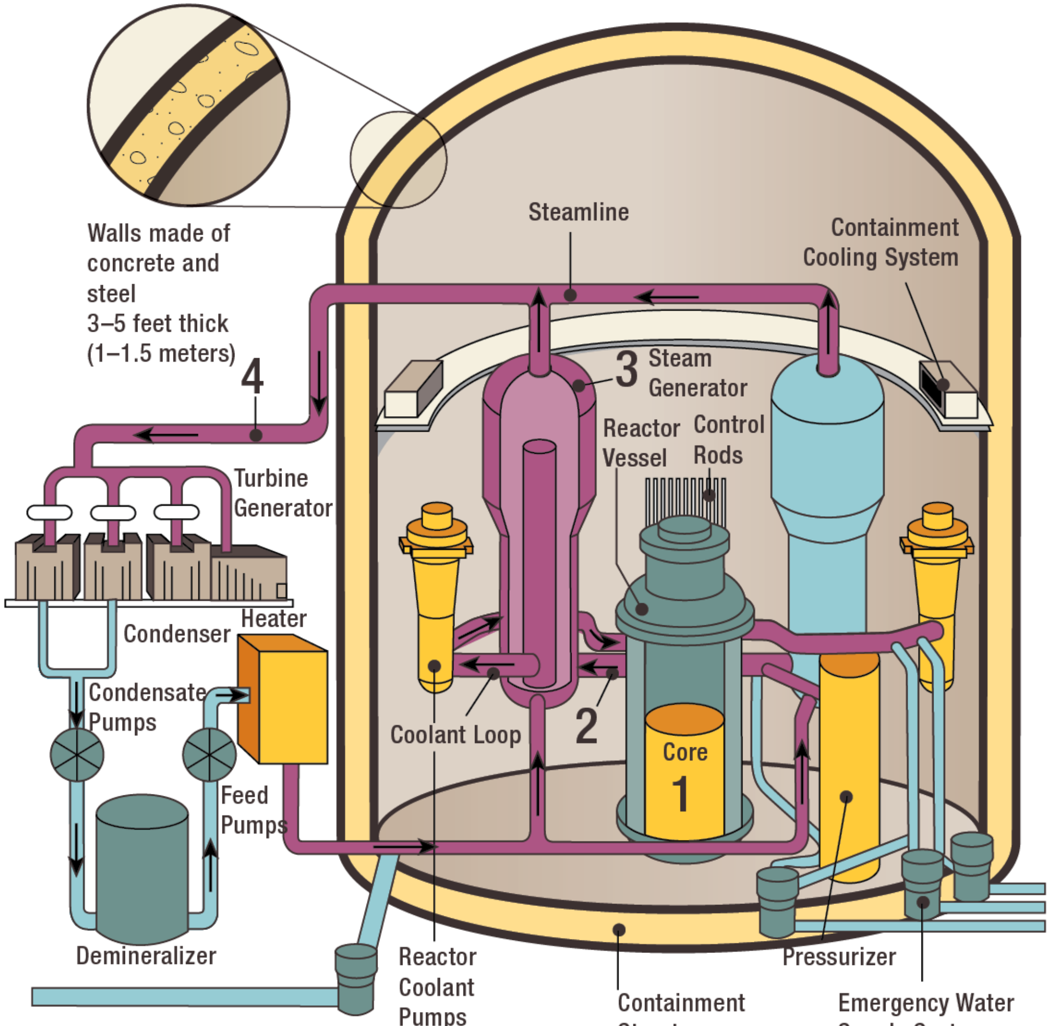
In a typical design concept of a commercial PWR, the following process occurs:

1. The core inside the reactor vessel creates heat.
2. Pressurized water in the primary coolant loop carries the heat to the steam generator.
3. Inside the steam generator, heat from the primary coolant loop vaporizes the water in a secondary loop, producing steam.
4. The steamline directs the steam to the main turbine, causing it to turn the turbine generator, which produces electricity.

The unused steam is exhausted to the condenser, where it is condensed into water. The resulting water is pumped out of the condenser with a series of pumps, reheated, and pumped back to the steam generator. The reactor's core contains fuel assemblies that are cooled by water circulated using electrically powered pumps. These pumps and other operating systems in the plant receive their power from the electrical grid. If offsite power is lost, emergency cooling water is supplied by other pumps, which can be powered by onsite diesel generators. Other safety systems, such as the containment cooling system, also need electric power. PWRs contain between 150–200 fuel assemblies.



Typical Pressurized-Water Reactor



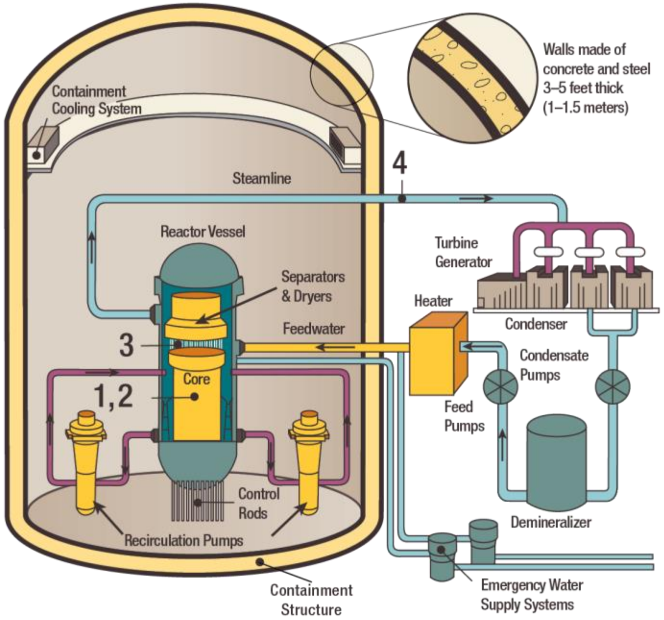
Typical Boiling-Water Reactor

How Nuclear Reactors Work

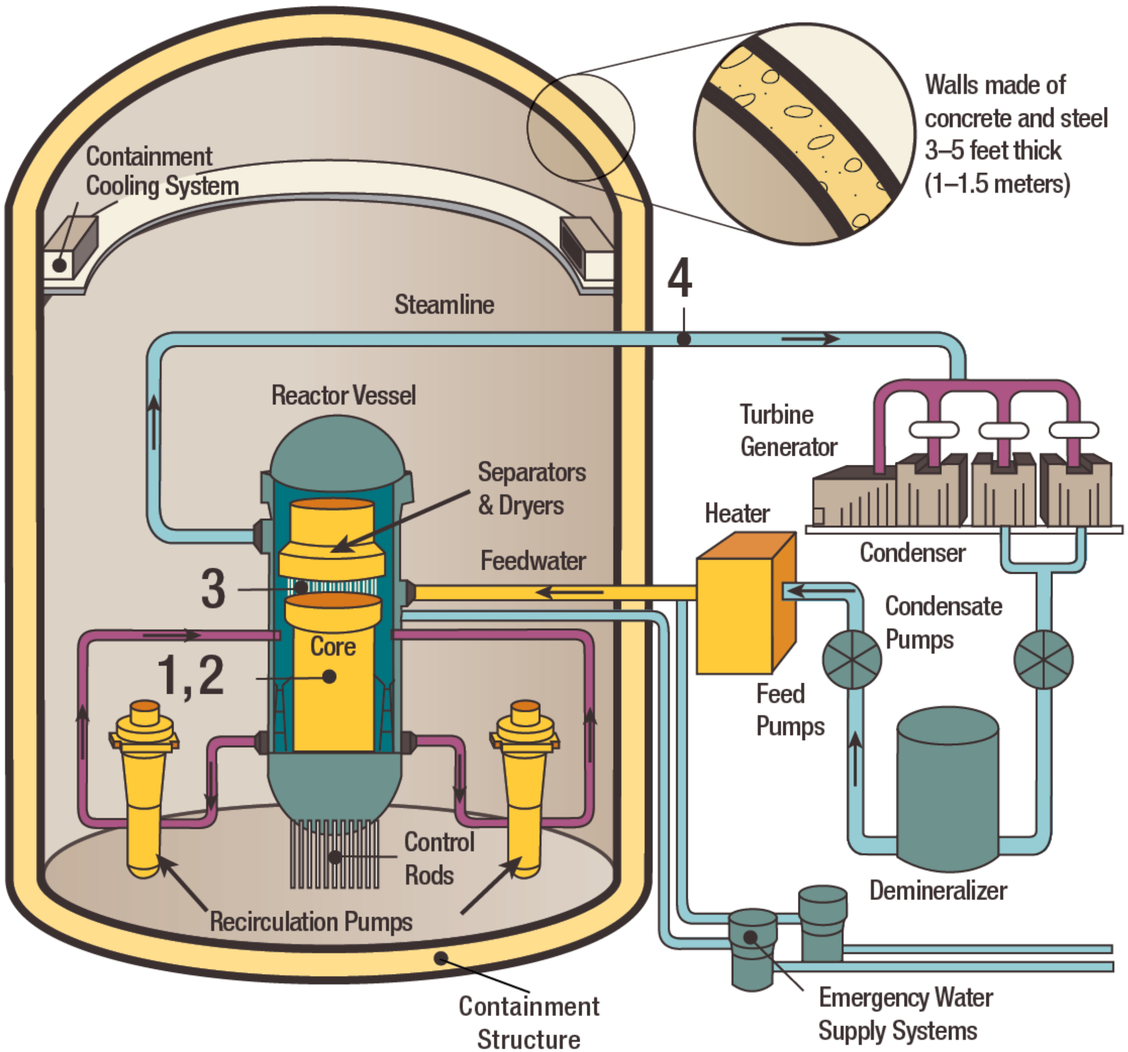
In a typical design concept of a commercial BWR, the following process occurs:

1. The core inside the reactor vessel creates heat.
2. A steam-water mixture is produced when very pure water (reactor coolant) moves upward through the core, absorbing heat.
3. The steam-water mixture leaves the top of the core and enters the two stages of moisture separation where water droplets are removed before the steam is allowed to enter the steamline.
4. The steamline directs the steam to the main turbine, causing it to turn the turbine generator, which produces electricity.

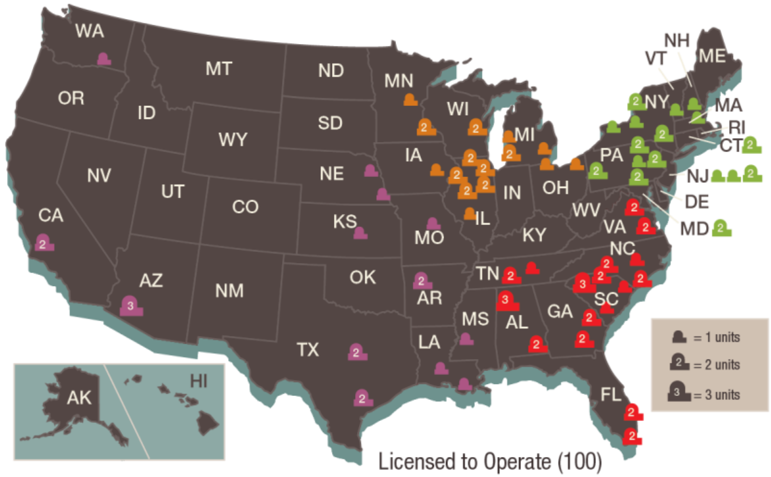
The unused steam is exhausted to the condenser, where it is condensed into water. The resulting water is pumped out of the condenser with a series of pumps, reheated, and pumped back to the reactor vessel. The reactor's core contains fuel assemblies that are cooled by water circulated using electrically powered pumps. These pumps and other operating systems in the plant receive their power from the electrical grid. If offsite power is lost, emergency cooling water is supplied by other pumps, which can be powered by onsite diesel generators. Other safety systems, such as the containment cooling system, also need electric power. BWRs contain between 370–800 fuel assemblies.



Typical Boiling-Water Reactor



U.S. Operating Commercial Nuclear Power Reactors



Licensed to Operate (100)

REGION I

CONNECTICUT
- Millstone 2 and 3

MARYLAND
- Calvert Cliffs 1 and 2

MASSACHUSETTS
- Pilgrim

NEW HAMPSHIRE
- Seabrook

NEW JERSEY
- Hope Creek
- Oyster Creek
- Salem 1 and 2

NEW YORK
- FitzPatrick
- Ginna
- Indian Point 2 and 3
- Nine Mile Point 1 and 2

PENNSYLVANIA
- Beaver Valley 1 and 2
- Limerick 1 and 2
- Peach Bottom 2 and 3
- Susquehanna 1 and 2
- Three Mile Island 1

VERMONT
- Vermont Yankee

REGION II

ALABAMA
- Browns Ferry 1, 2, and 3
- Farley 1 and 2

FLORIDA
- St. Lucie 1 and 2
- Turkey Point 3 and 4

GEORGIA
- Edwin I. Hatch 1 and 2
- Vogtle 1 and 2

NORTH CAROLINA
- Brunswick 1 and 2
- McGuire 1 and 2
- Harris 1

SOUTH CAROLINA
- Catawba 1 and 2
- Oconee 1, 2, and 3
- Robinson 2
- Summer

TENNESSEE
- Sequoyah 1 and 2
- Watts Bar 1

VIRGINIA
- North Anna 1 and 2
- Surry 1 and 2

REGION III

ILLINOIS
- Braidwood 1 and 2
- Byron 1 and 2
- Clinton
- Dresden 2 and 3
- LaSalle 1 and 2
- Quad Cities 1 and 2

IOWA
- Duane Arnold

MICHIGAN
- Cook 1 and 2
- Fermi 2
- Palisades

MINNESOTA
- Monticello
- Prairie Island 1 and 2

OHIO
- Davis-Besse
- Perry

WISCONSIN
- Point Beach 1 and 2

REGION IV

ARKANSAS
- Arkansas Nuclear 1 and 2

ARIZONA
- Palo Verde 1, 2, and 3

CALIFORNIA
- Diablo Canyon 1 and 2

KANSAS
- Wolf Creek 1

LOUISIANA
- River Bend 1
- Waterford 3

MISSISSIPPI
- Grand Gulf

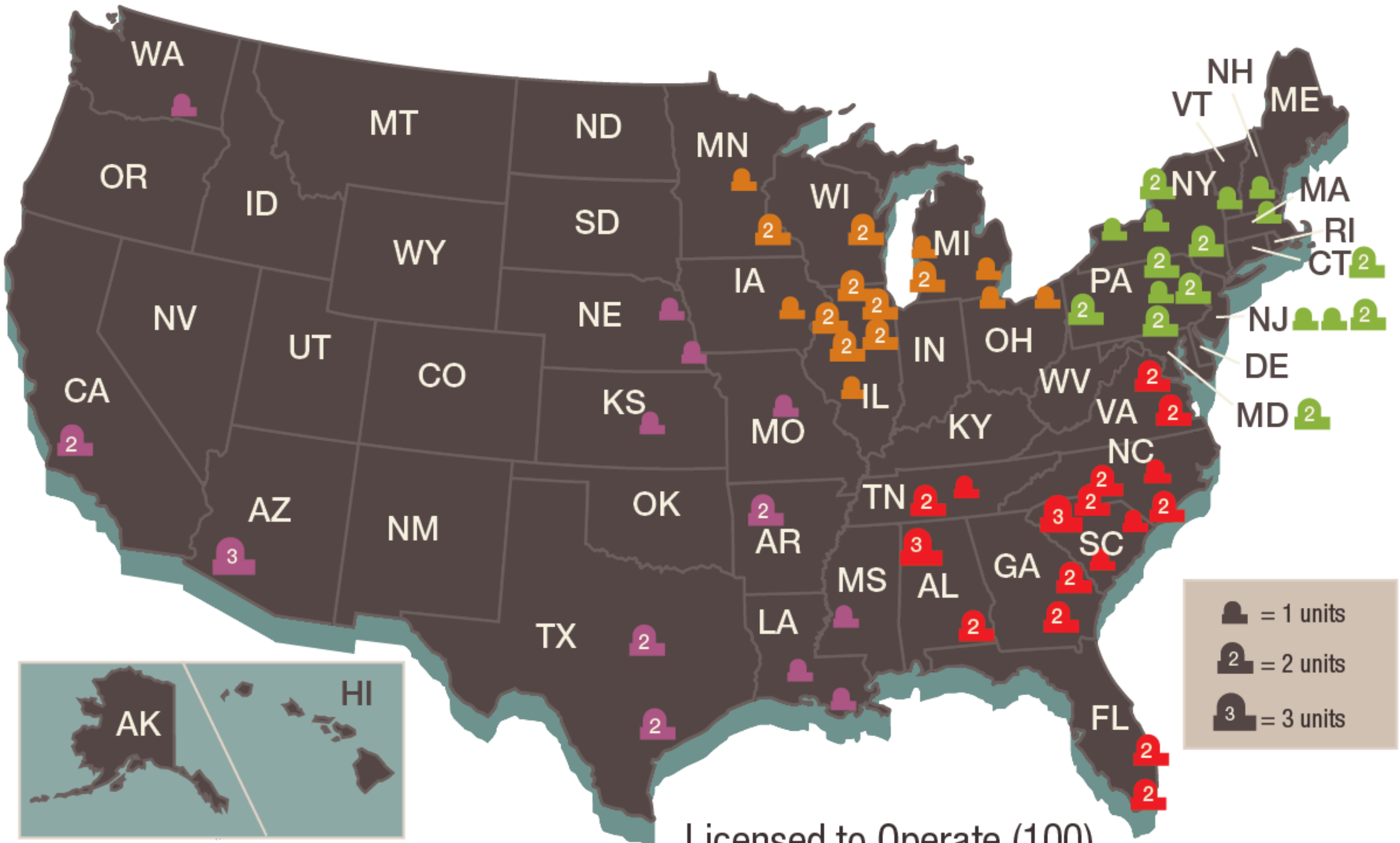
MISSOURI
- Callaway

NEBRASKA
- Cooper
- Fort Calhoun

TEXAS
- Comanche Peak 1 and 2
- South Texas Project 1 and 2

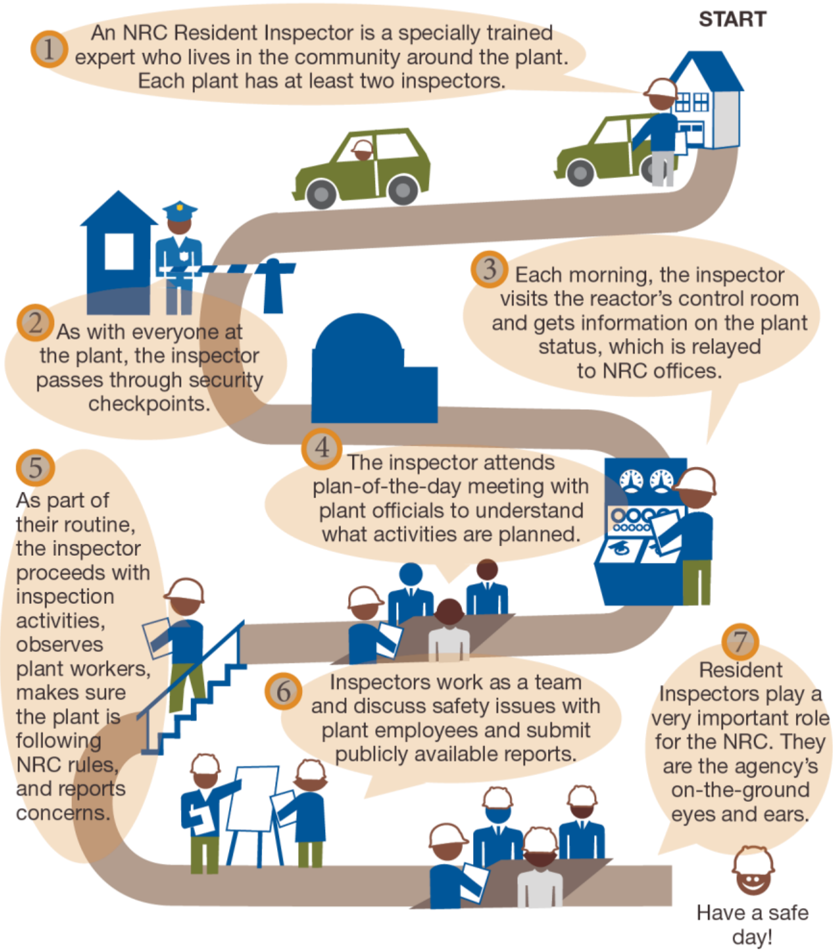
WASHINGTON
- Columbia

U.S. Operating Commercial Nuclear Power Reactors



Licensed to Operate (100)

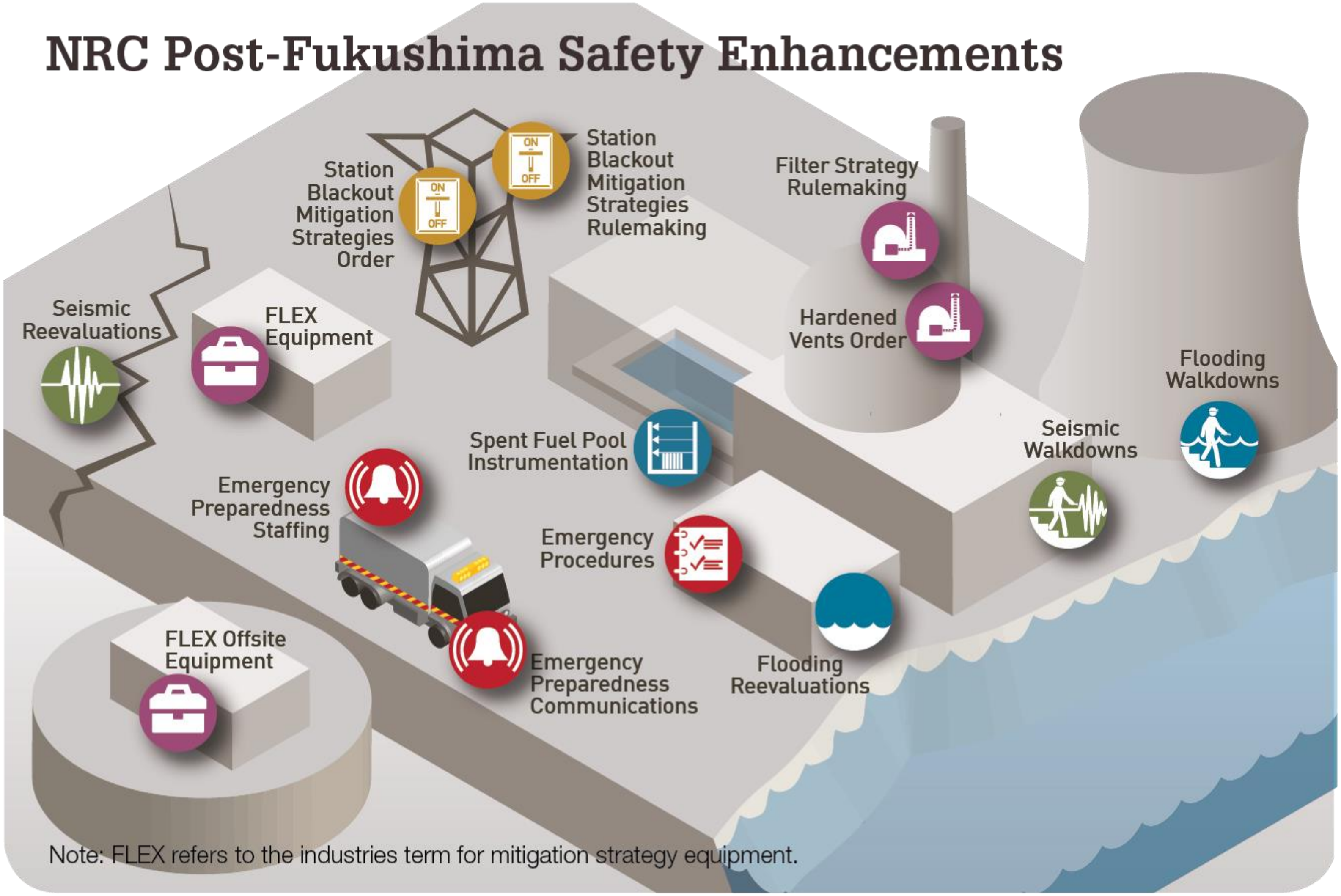
Day in the Life of an NRC Resident Inspector



YouTube Learn more about Resident Inspectors. Watch the videos on the NRC YouTube Channel at: www.youtube.com/user/NRCgov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

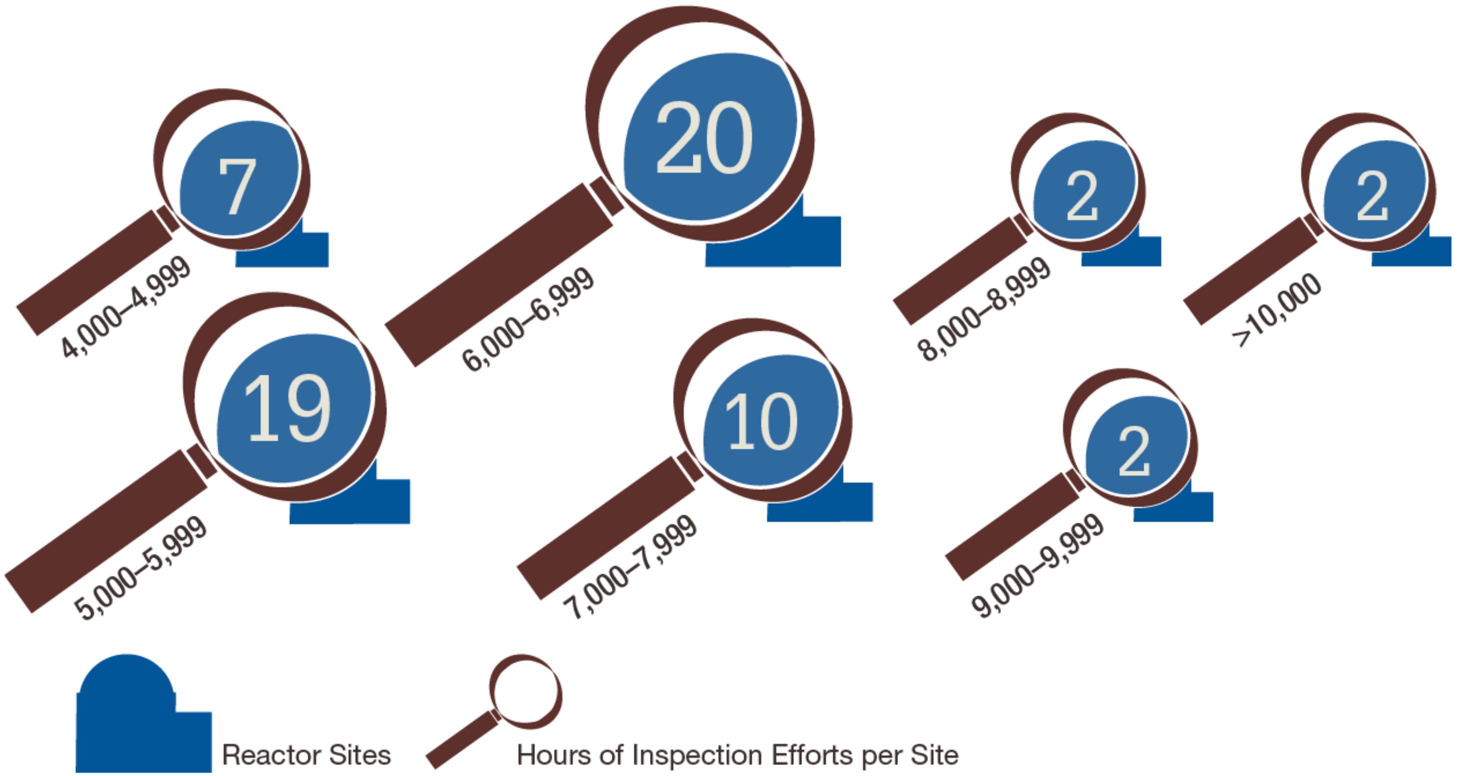
NRC Post-Fukushima Safety Enhancements



Note: FLEX refers to the industries term for mitigation strategy equipment.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Inspection Effort at Operating Reactors, 2013



Note: Data include calendar year (CY) 2013 hours for all activities related to baseline, plant-specific, generic safety issue, and allegation inspections.

Reactor Oversight Action Matrix Performance Indicators

Performance Indicators

GREEN | WHITE | YELLOW | RED

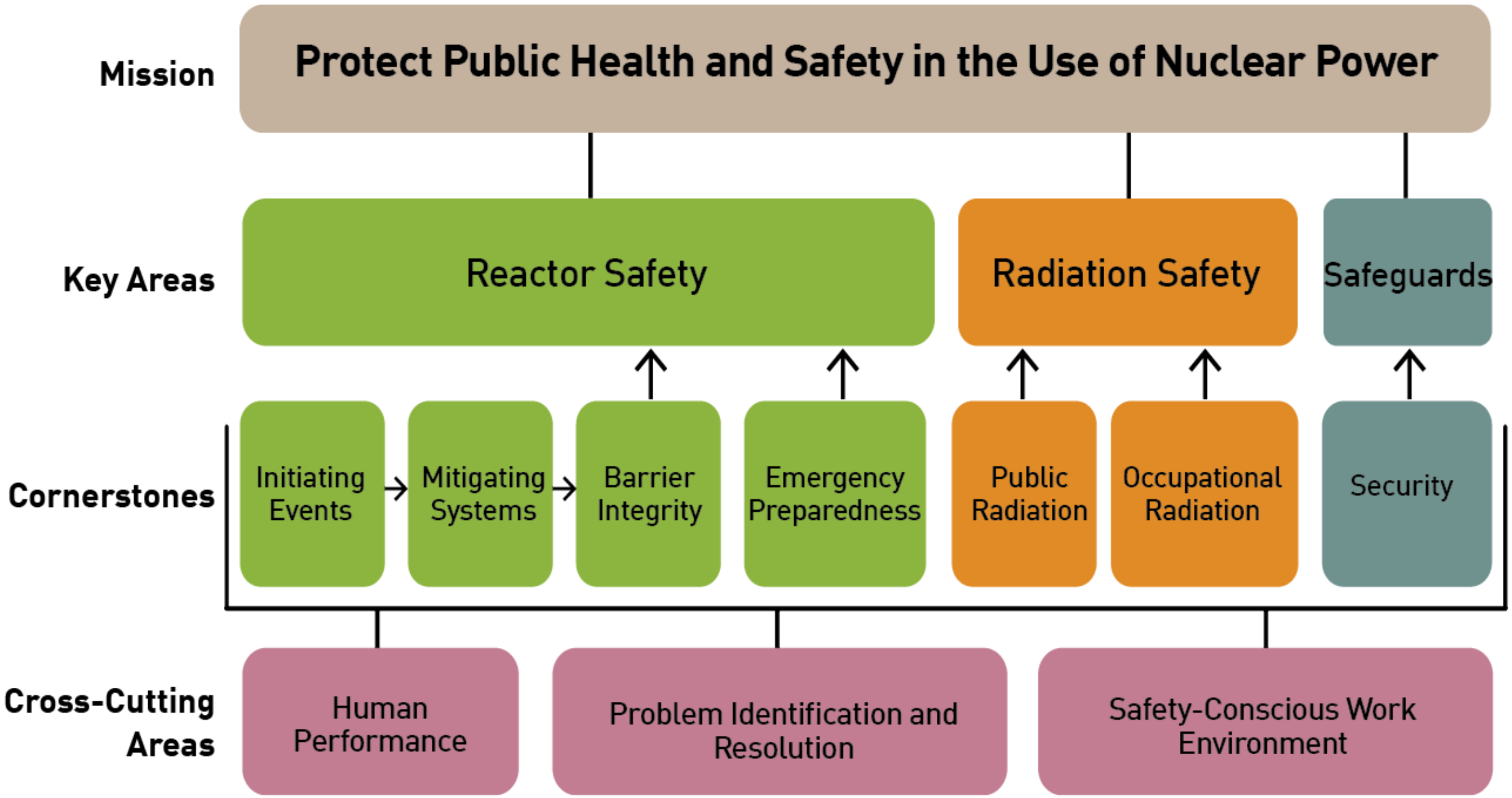
Increasing Safety Significance →

Inspection Findings

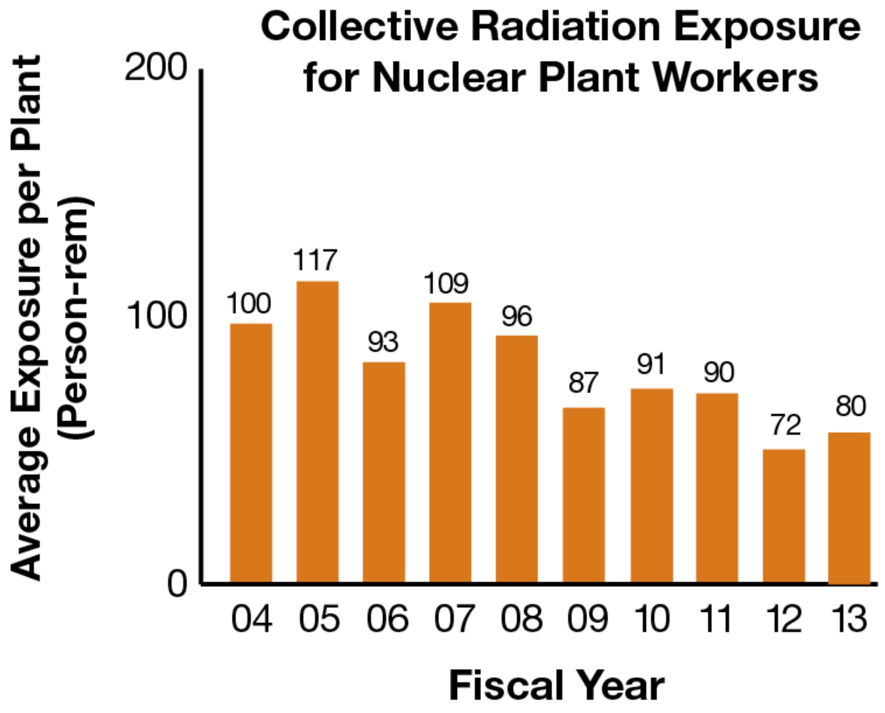
GREEN | WHITE | YELLOW | RED

Increasing Safety Significance →

Reactor Oversight Framework



Industry Performance Indicators: Industry Averages, FYs 2004–2013



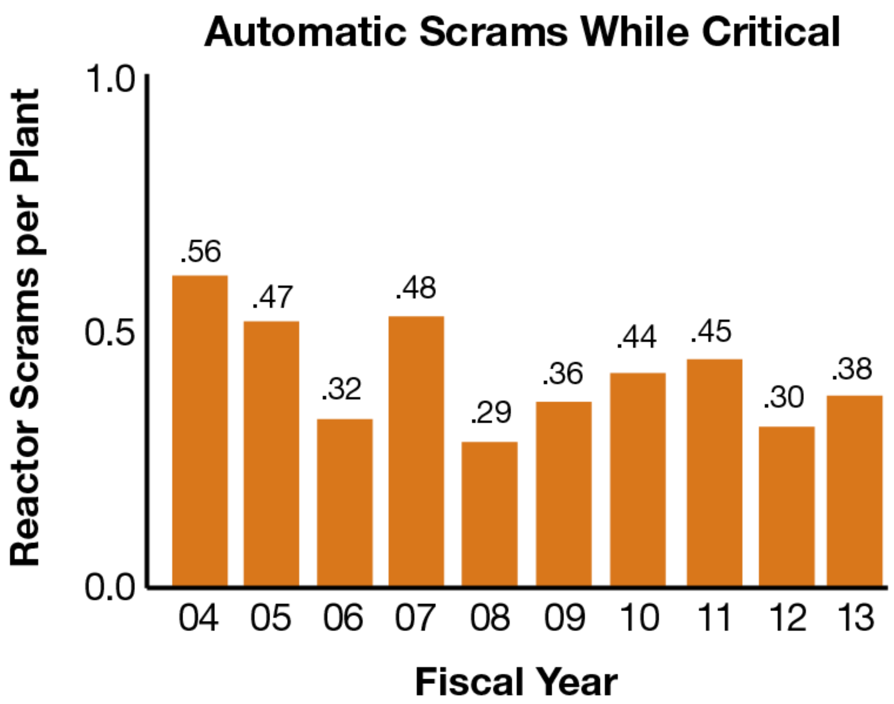
This indicator monitors the total radiation dose accumulated by plant personnel.

Further Explanation:
In 2013, those workers receiving a measurable dose of radiation received an average of about 0.1 rem. For comparison purposes, the average U.S. citizen receives 0.3 rem of radiation each year from natural sources (i.e., the everyday environment). See the definition of "exposure" in the Glossary.

Note: Data represents annual industry averages for operating reactors. The data is continuously updated to incorporate recent information and any subsequent changes in its analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

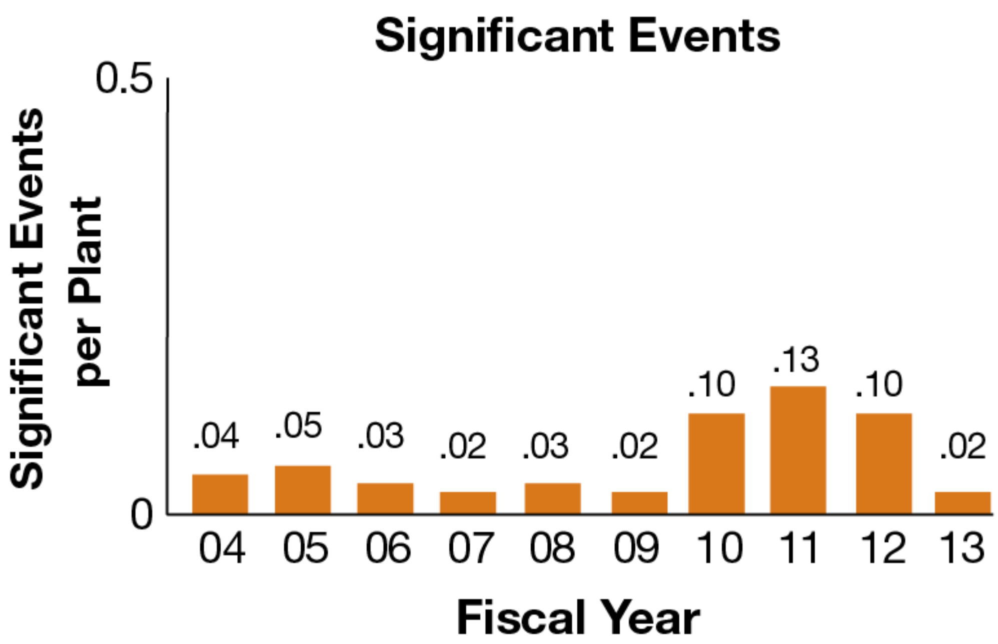


A reactor is considered "critical" when it achieves a self-sustaining nuclear chain reaction, such as when the reactor is operating. The sudden shutting down of a nuclear reactor by the rapid insertion of control rods, either automatically or manually by the reactor operator, is referred to as a "scram." This indicator measures the number of unplanned automatic scrams that occurred while the reactor was critical.

Note: Data represents annual industry averages for operating reactors. The data is continuously updated to incorporate recent information and any subsequent changes in its analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

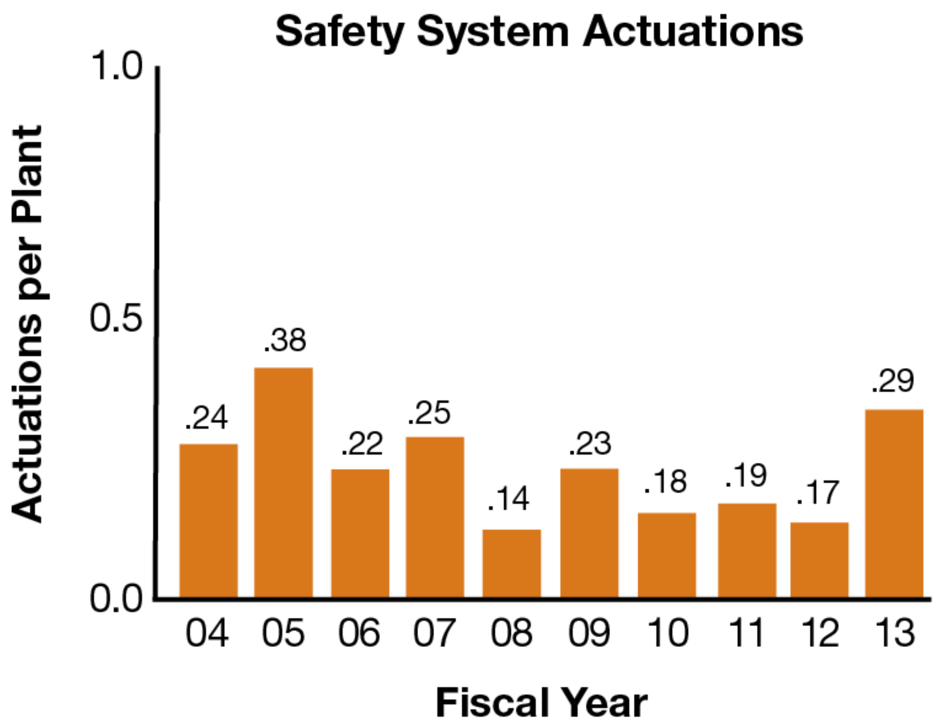


Significant events are events that meet specific NRC criteria—for example, degradation of safety equipment, a sudden reactor shutdown with complications, or an unexpected response to a sudden degradation of fuel or pressure boundaries. The NRC staff identifies significant events through detailed screening and evaluation of operating experience.

Note: Data represents annual industry averages for operating reactors. The data is continuously updated to incorporate recent information and any subsequent changes in its analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

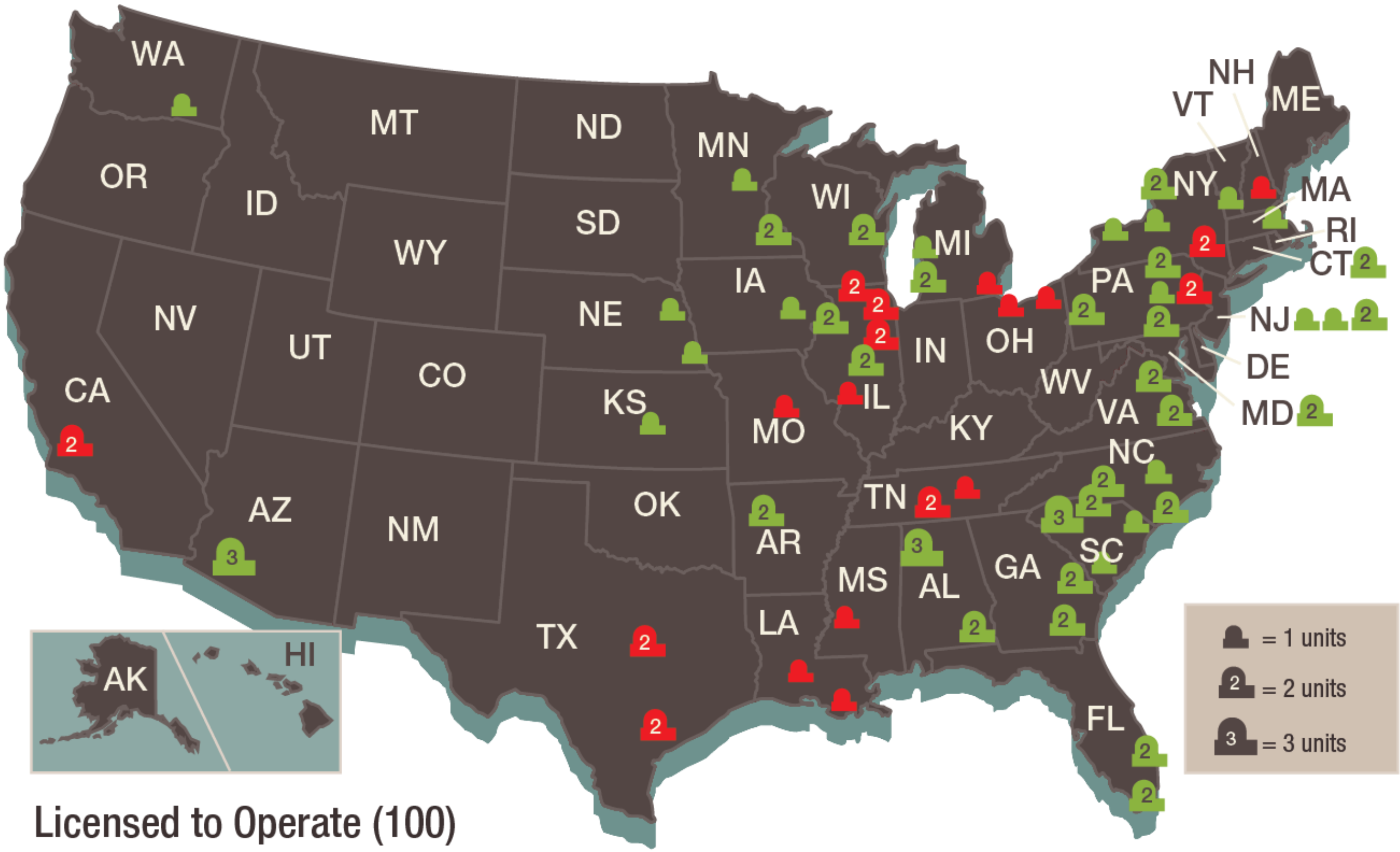


Safety system actuations are certain manual or automatic actions taken to start emergency core cooling systems or emergency power systems. These systems are specifically designed to either remove heat from the reactor fuel rods if the normal core cooling system fails or to provide emergency electrical power if the normal electrical systems fail.

Note: Data represents annual industry averages for operating reactors. The data is continuously updated to incorporate recent information and any subsequent changes in its analysis.

Source: Licensee data as compiled by the NRC

License Renewals Granted for Operating Nuclear Power Reactors



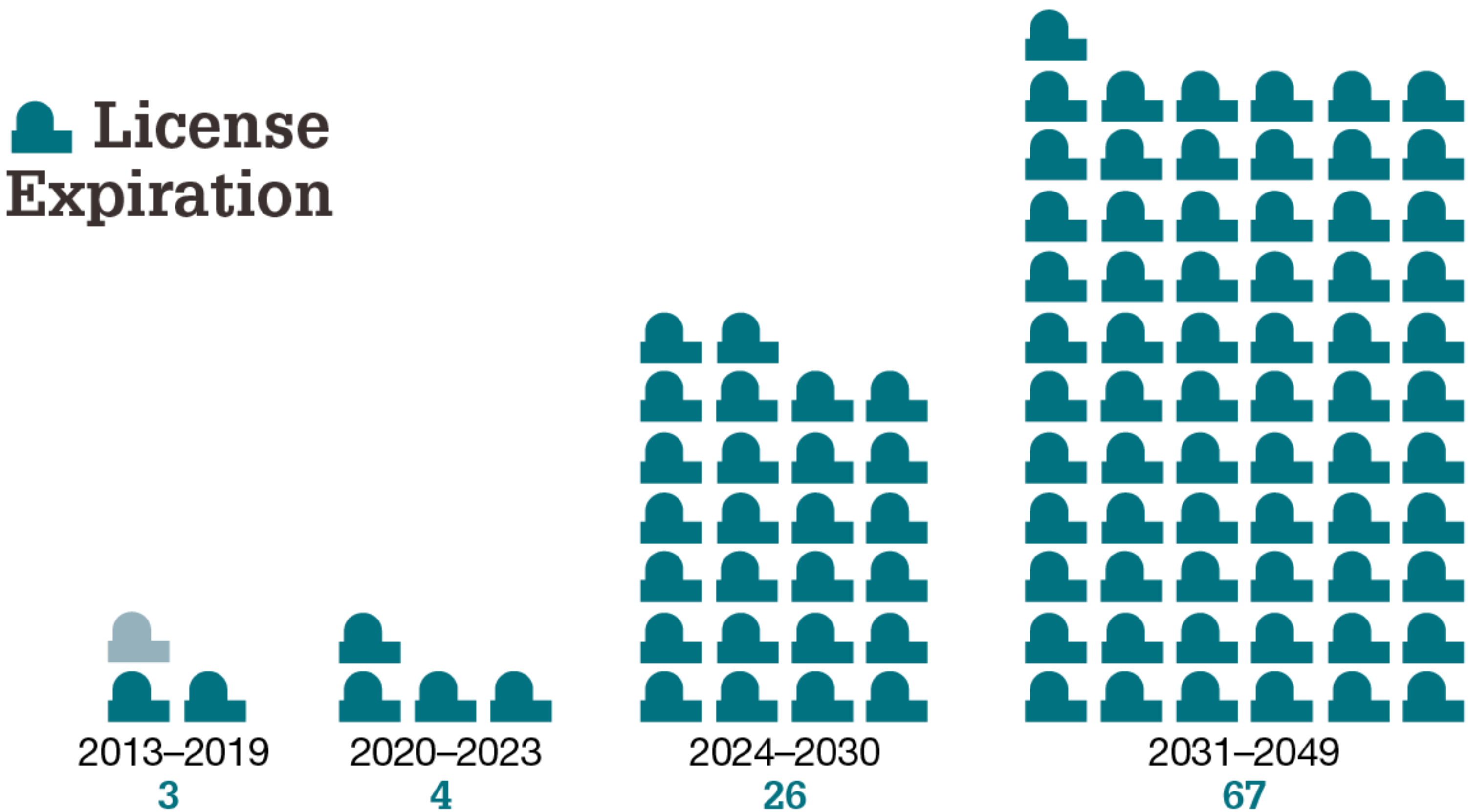
Licensed to Operate (100)

Original License (28) License Renewal Granted (72)

U.S. Commercial Nuclear Power Reactors—Years of Operation by the End of 2014

Note: Ages have been rounded up to the end of the year. These numbers include Vermont Yankee, which is scheduled to cease operations at the end of 2014.

U.S. Commercial Nuclear Power Reactor Operating Licenses—Expiration by Year

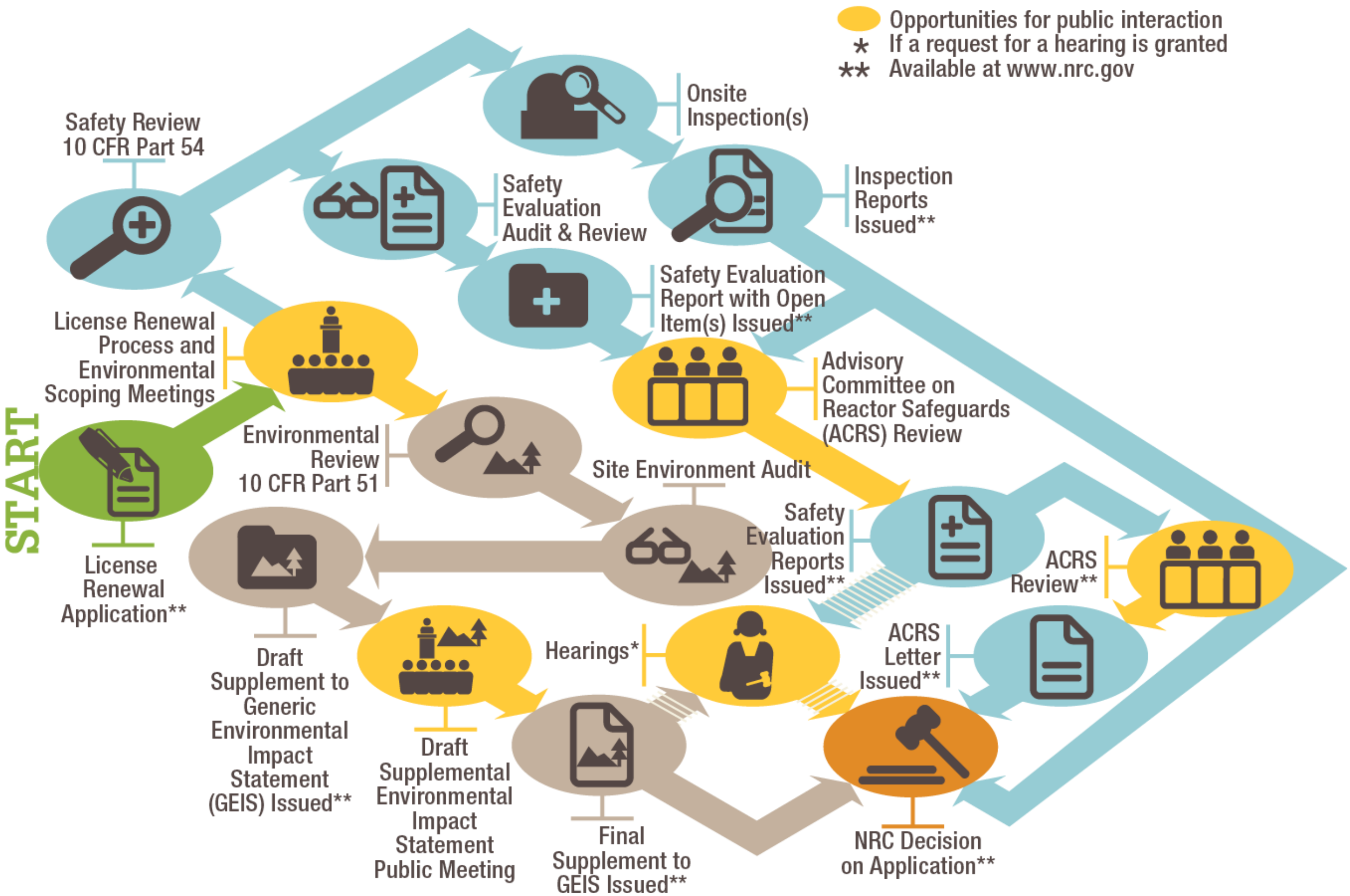


Indicates Indian Point 2, which entered timely renewal on Sept. 29, 2013.

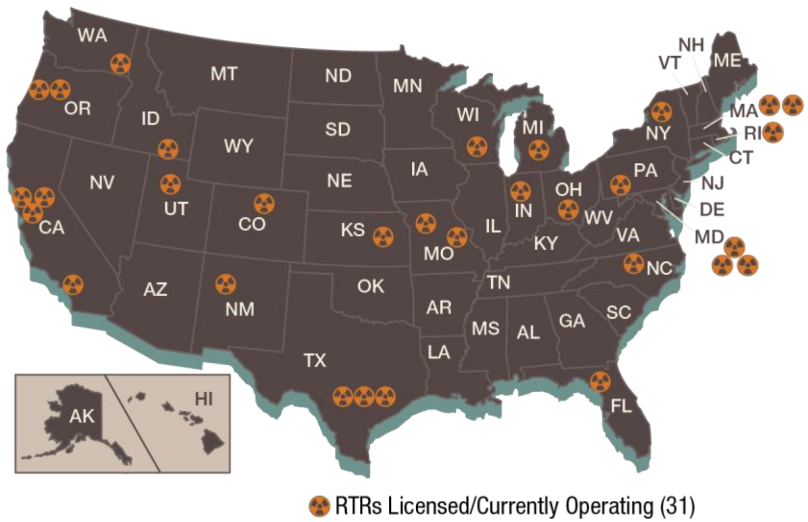
Note: These numbers include Vermont Yankee, which is scheduled to cease operations at the end of 2014.

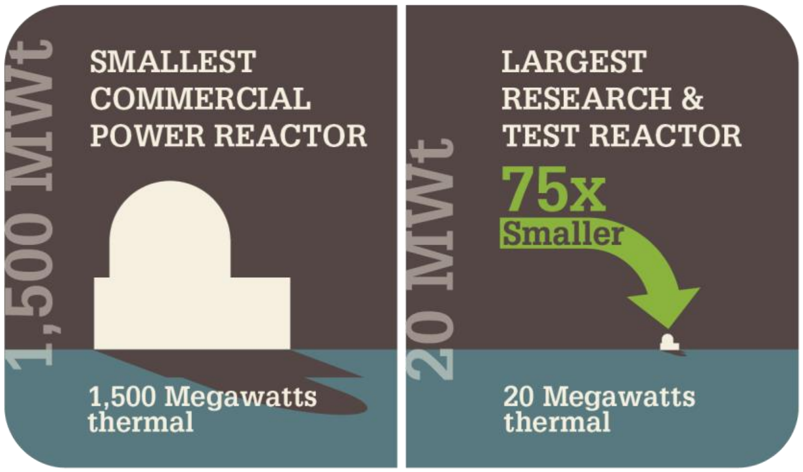
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

License Renewal Process

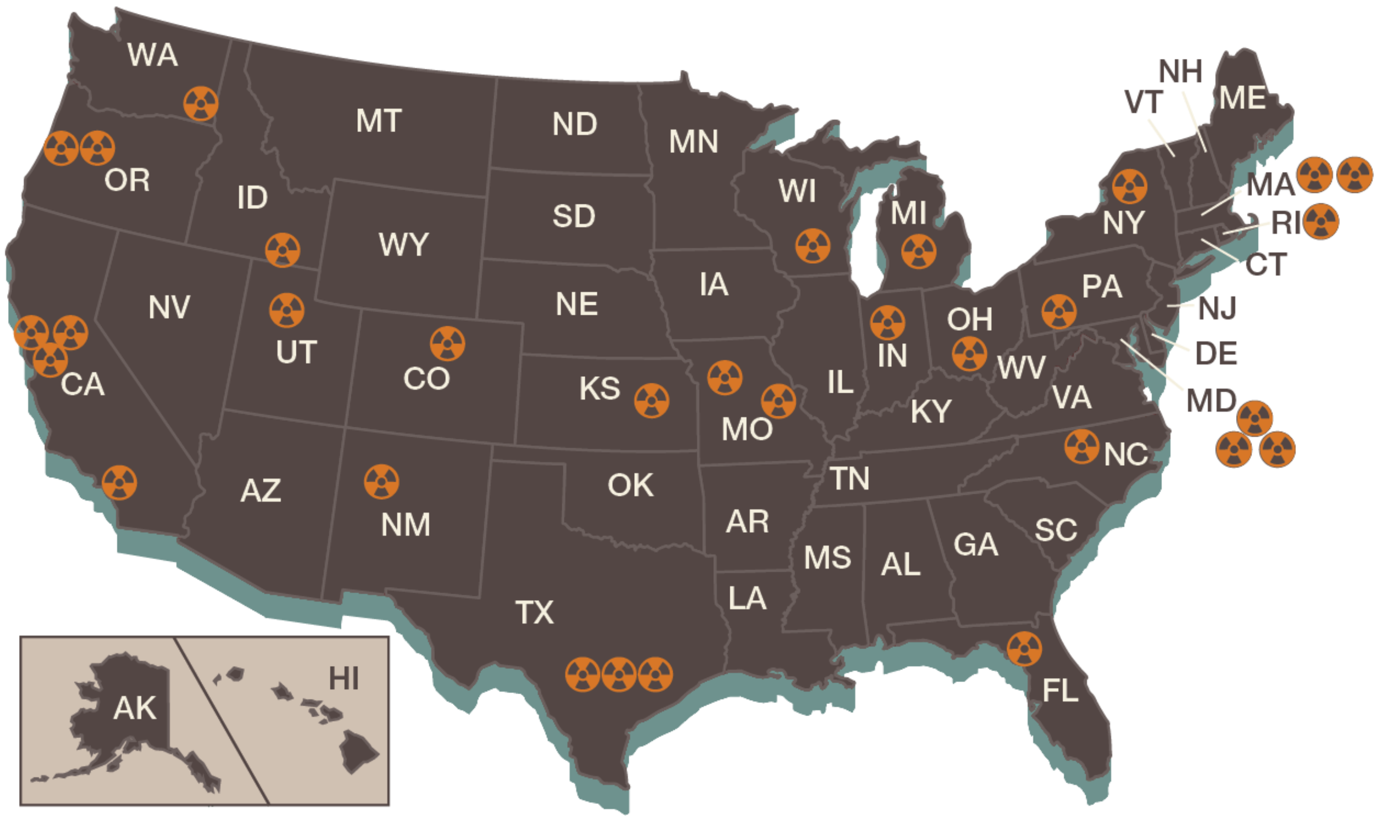


U.S. Nuclear Research and Test Reactors



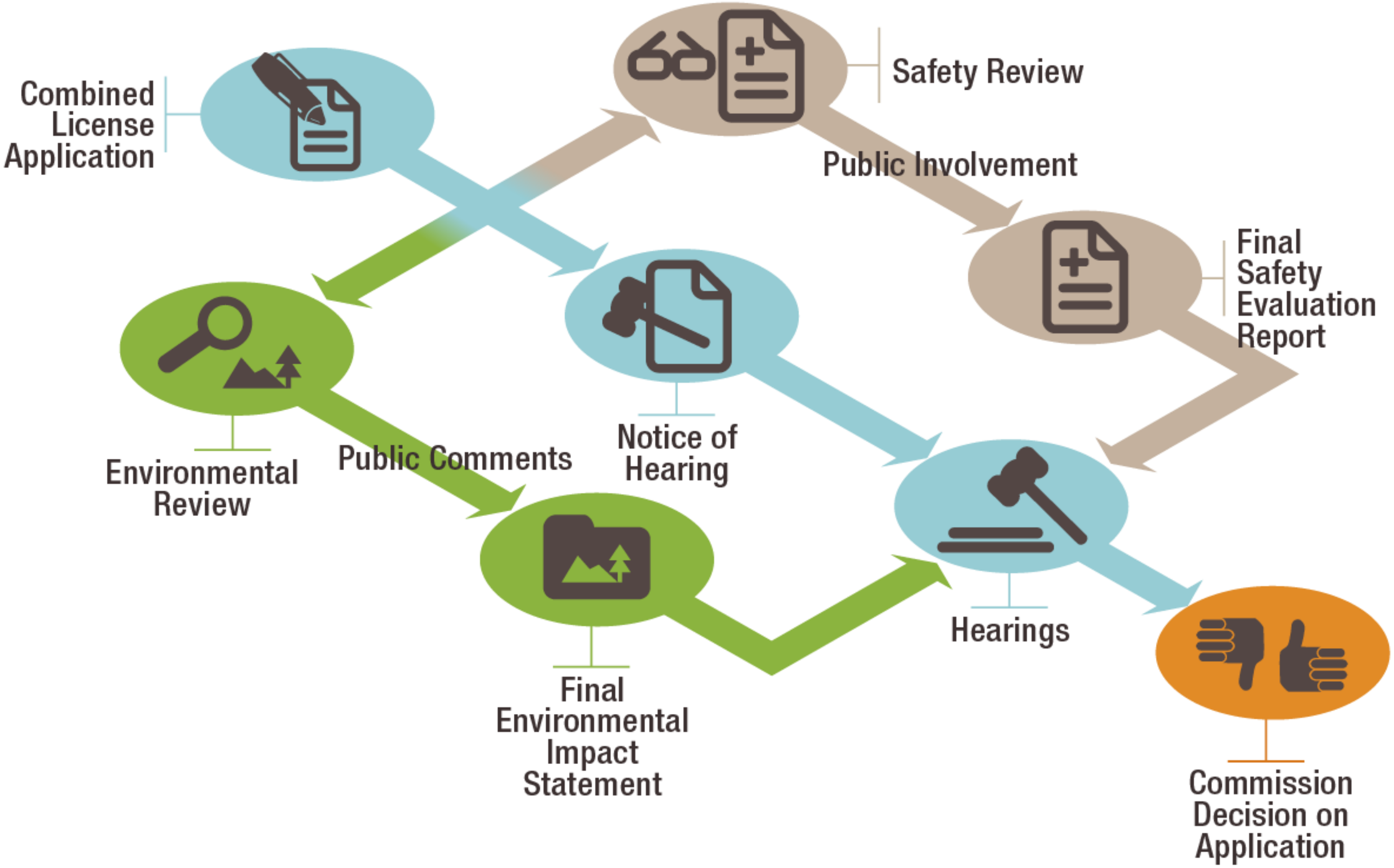


U.S. Nuclear Research and Test Reactors



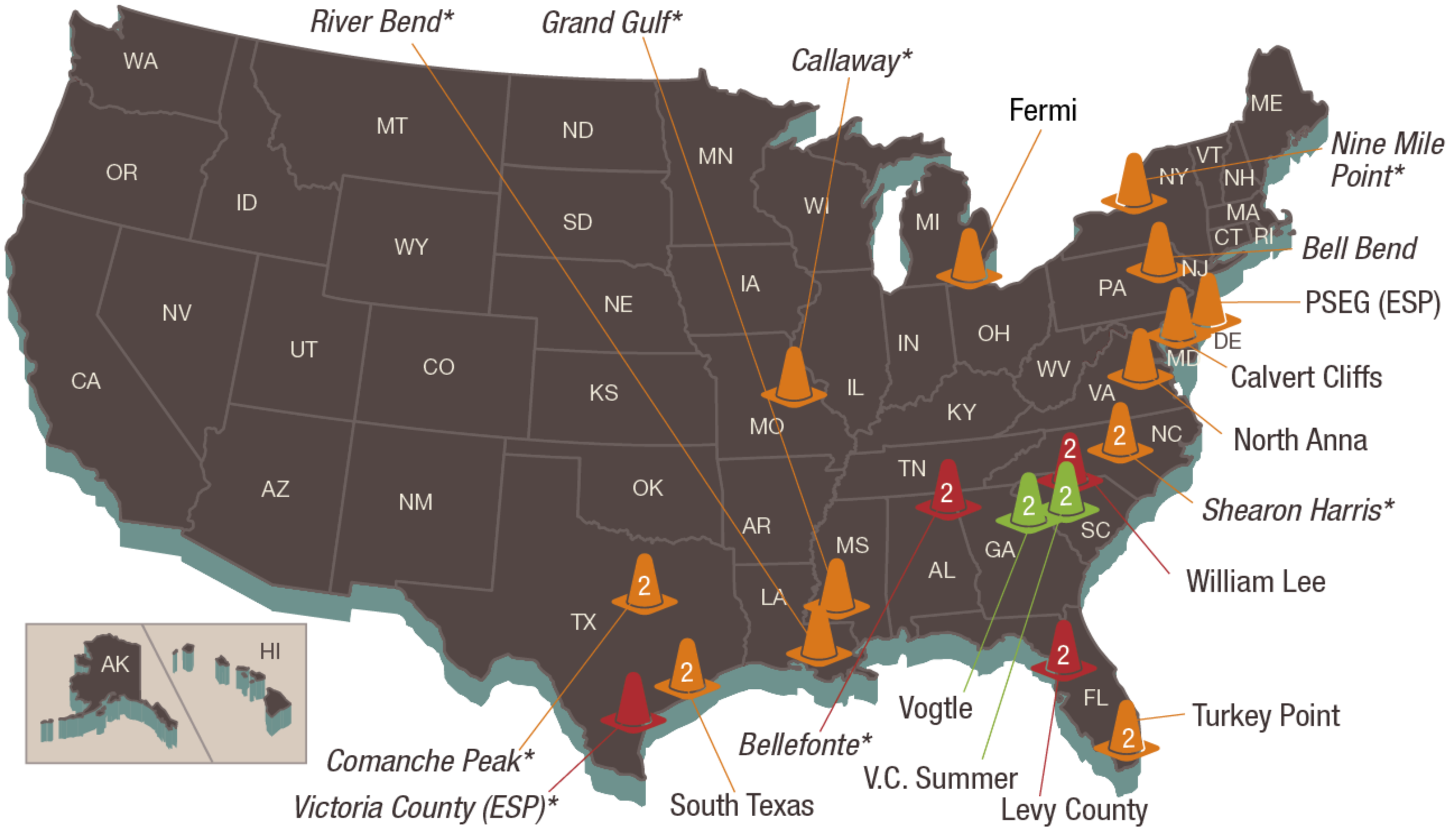
RTRs Licensed/Currently Operating (31)

New Reactor Licensing Process



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Locations of New Nuclear Power Reactors Applications



= A proposed new reactor at or near an existing nuclear plant

= A proposed reactor at a site that has not previously produced nuclear power

= Approved reactor

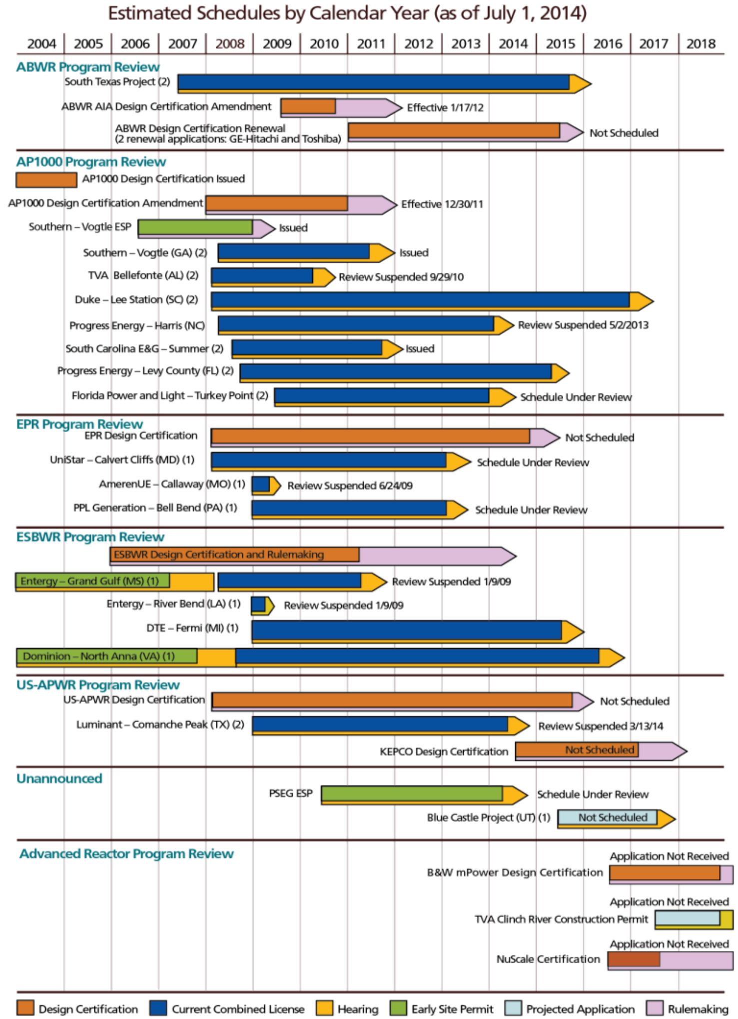
= 1 unit

2 = 2 units

** Review suspended*

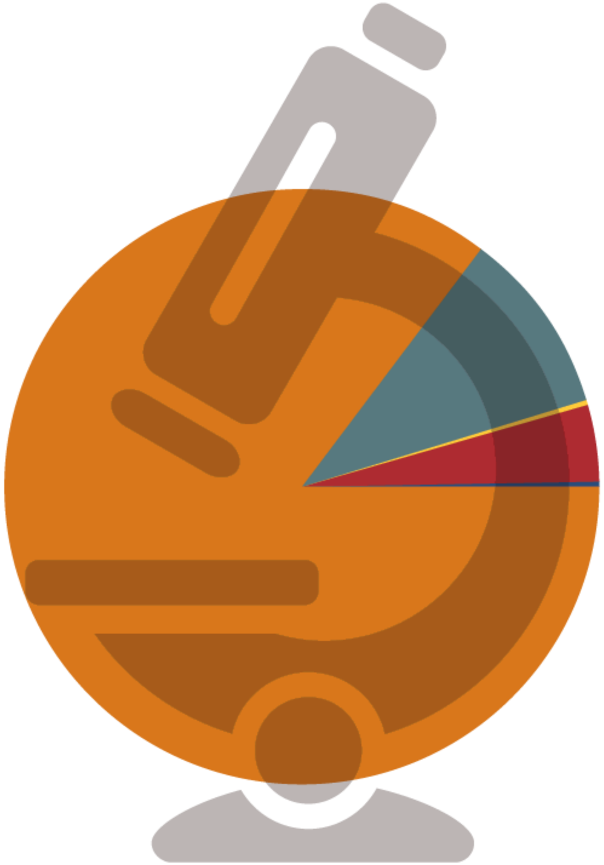
Note: Data is as of June 2014.

New Reactor Licensing Schedule of Applications by Design



Note: Lines depict approximate dates on schedule. Data on projected applications are based on information from potential applicants and are subject to change. Schedules depicted for future activities represent nominal assumed review durations based on submittal timeframes in letters of intent from prospective applicants. Numbers in ( ) next to the COL name indicate the number of units per site. The acceptance review is included at the beginning of the COL review. The rules in 10 CFR Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," govern hearings on COLs.

NRC Research Funding, FY 2014



Total $50 Million

- Reactor Program—$42.7 M
- New/Advanced Reactor Licensing—$5.0 M
- Homeland Security—$0.2 M
- Materials and Waste—$2.0 M
- Infrastructure Support—$0.1 M

Note: Totals may not equal sum of components because of independent rounding.

Moisture Density Gauge

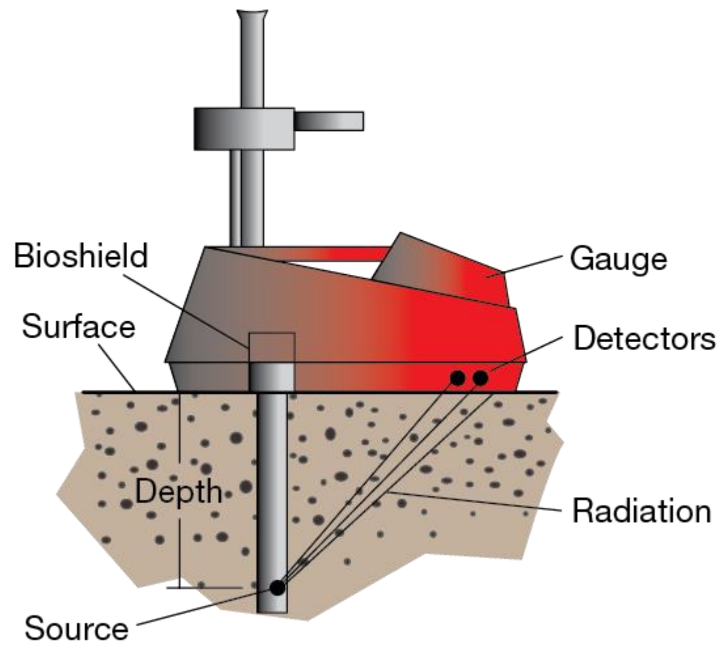
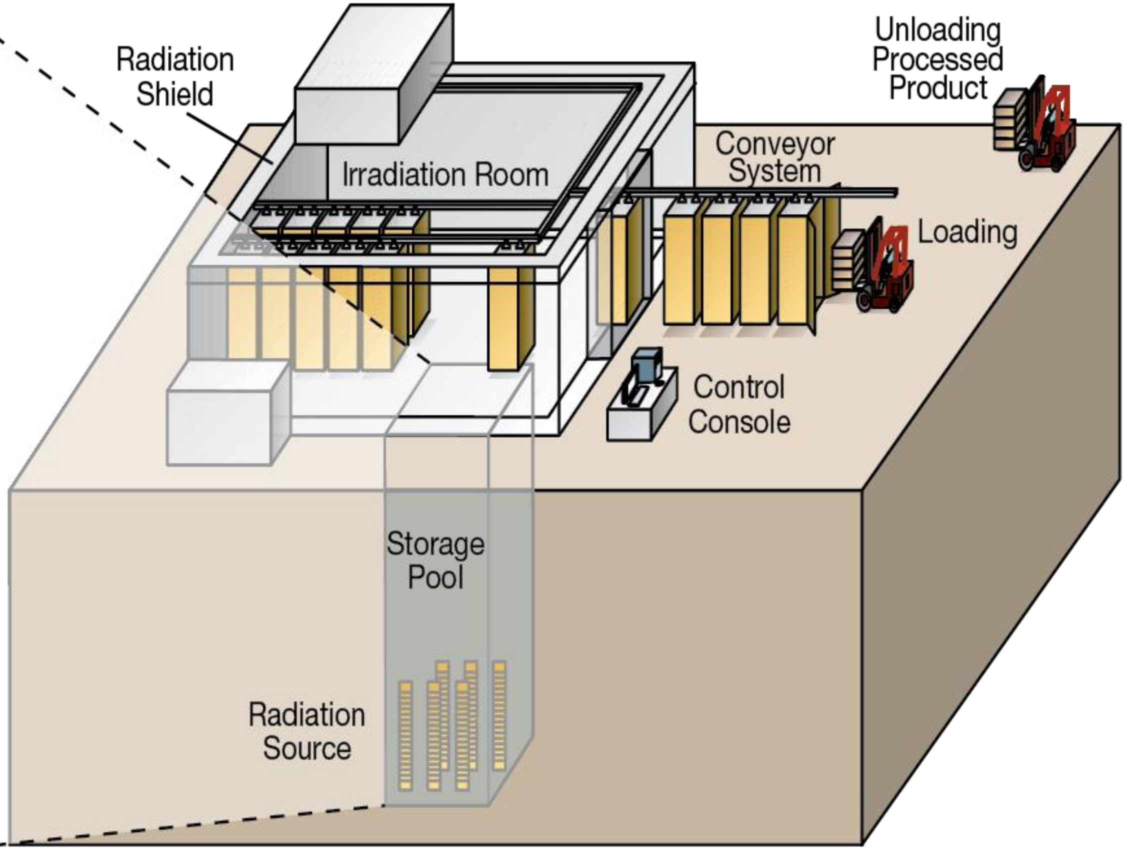


Photo courtesy: APNGA

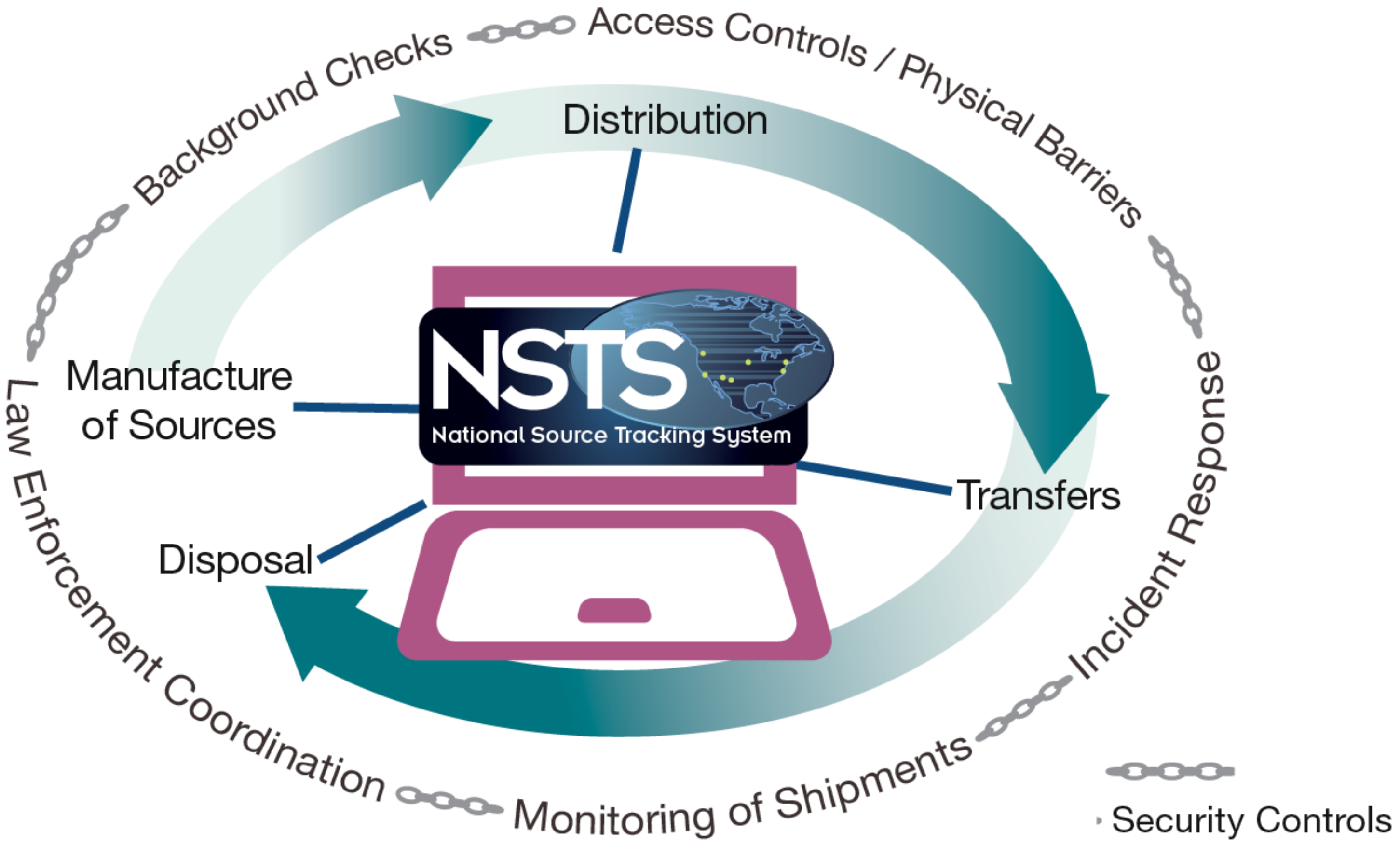
A moisture density gauge indicates whether a foundation is suitable for constructing a building or roadway.

Commercial Irradiator

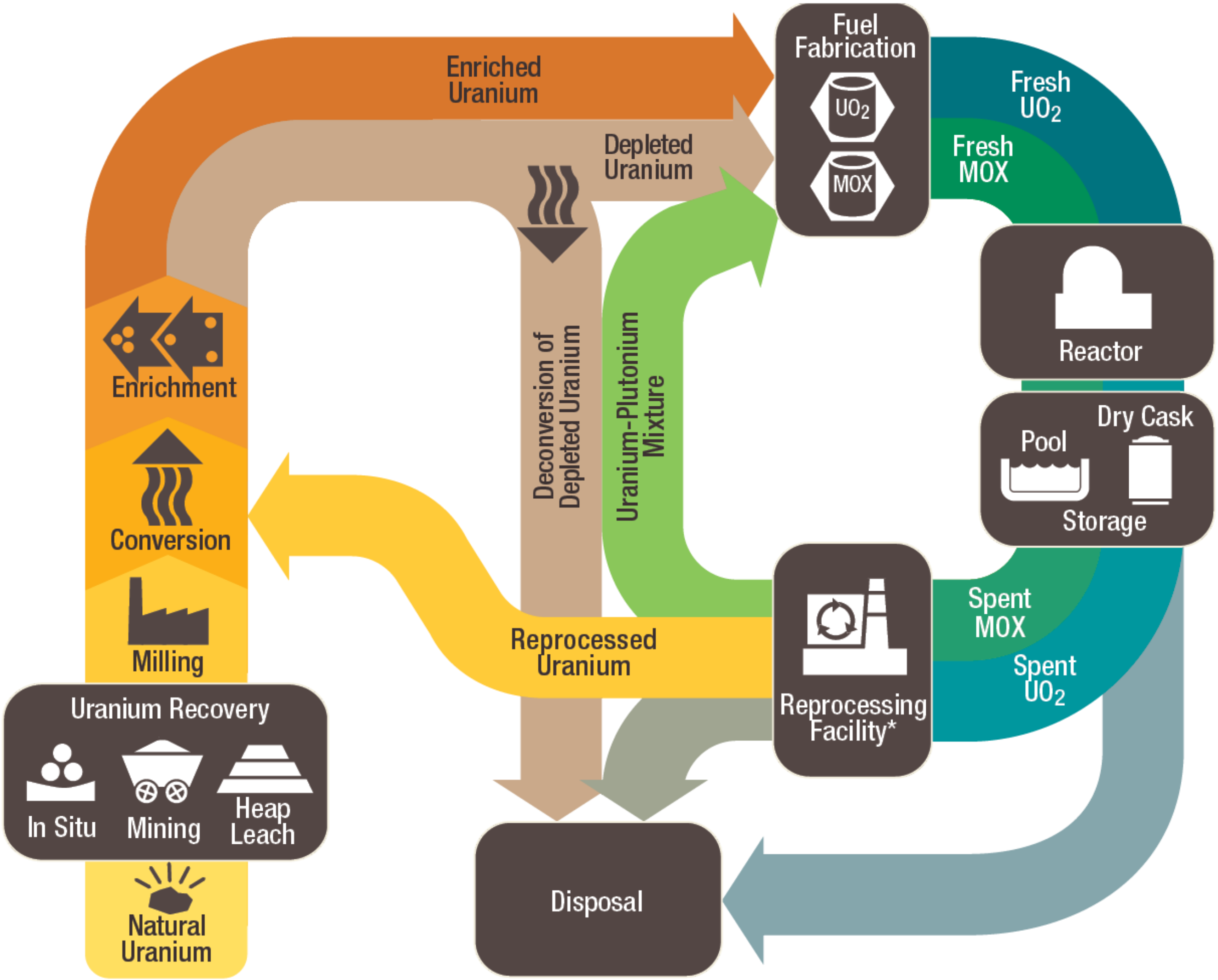
Photo courtesy: Nordion



Life-Cycle Approach to Source Security

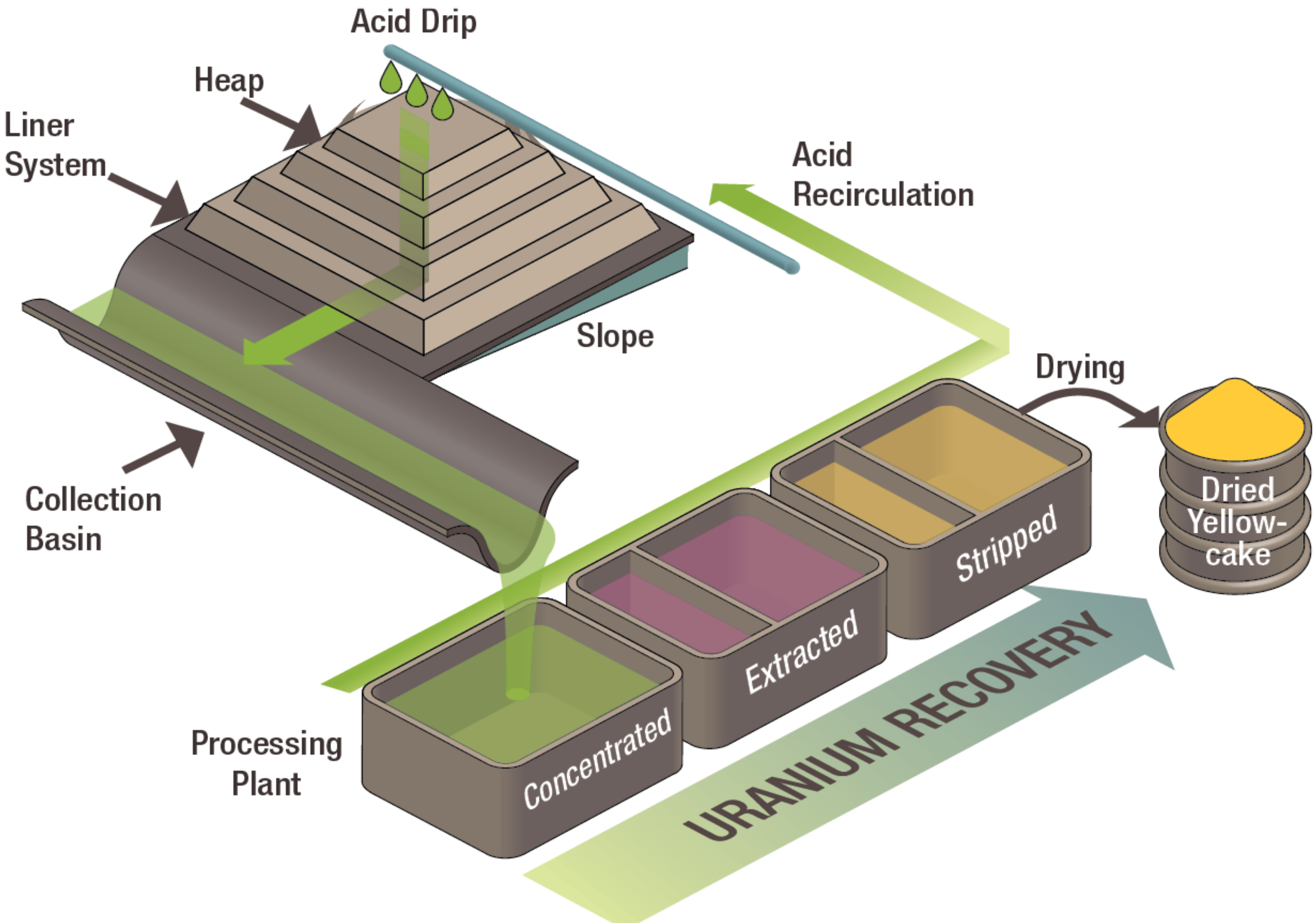


The Nuclear Fuel Cycle

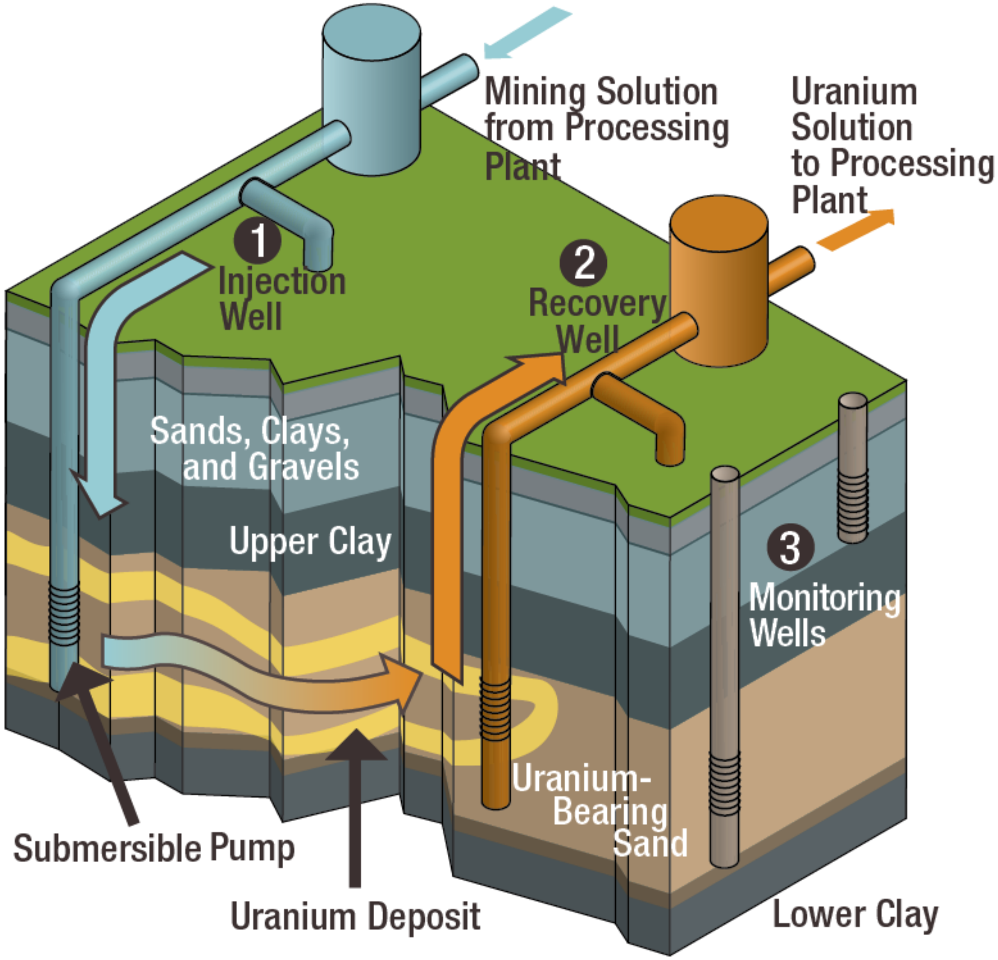


* Reprocessing of spent nuclear fuel including mixed-oxide fuel (MOX) is not practiced in the United States.
Note: The NRC has no regulatory role in mining uranium.

The Heap Leach Recovery Process

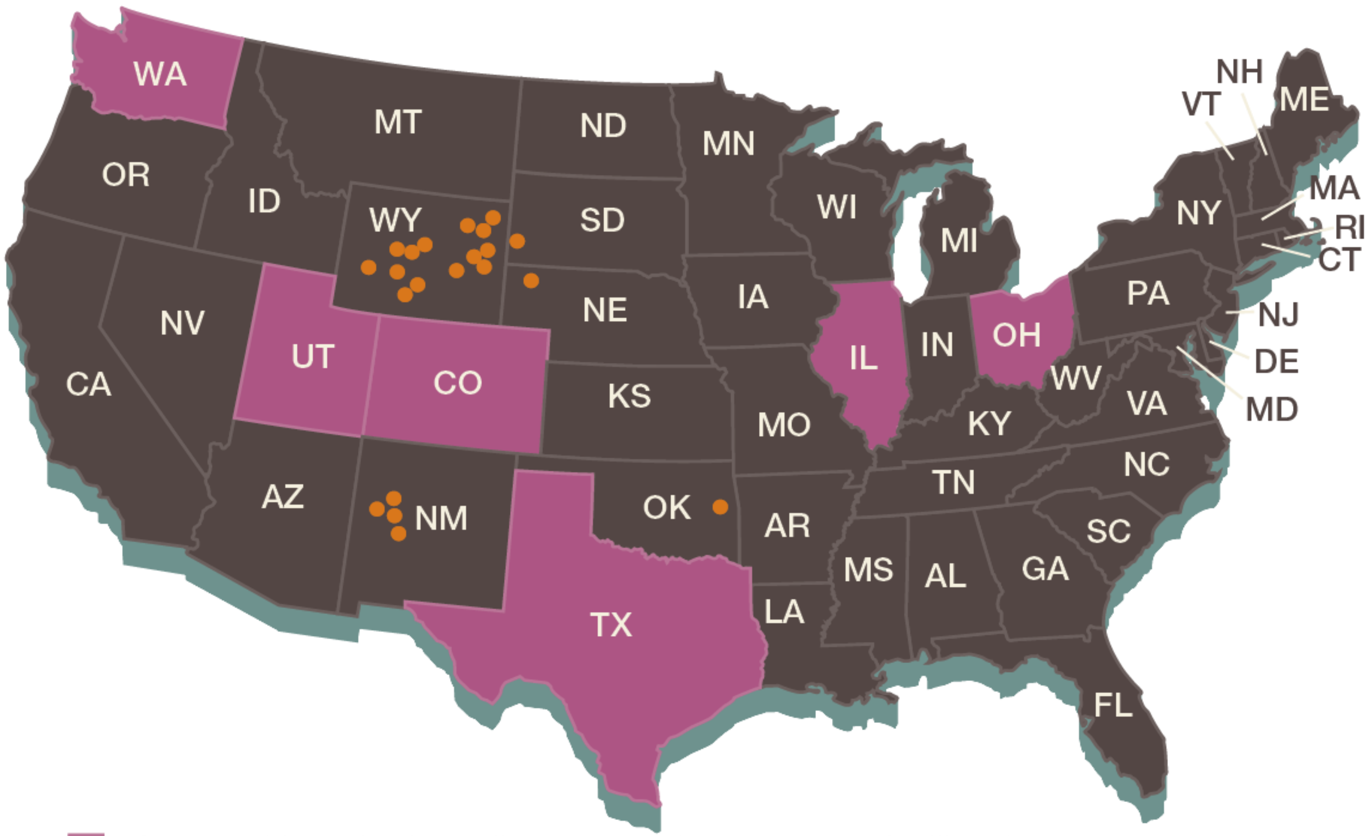


The In Situ Uranium Recovery Process



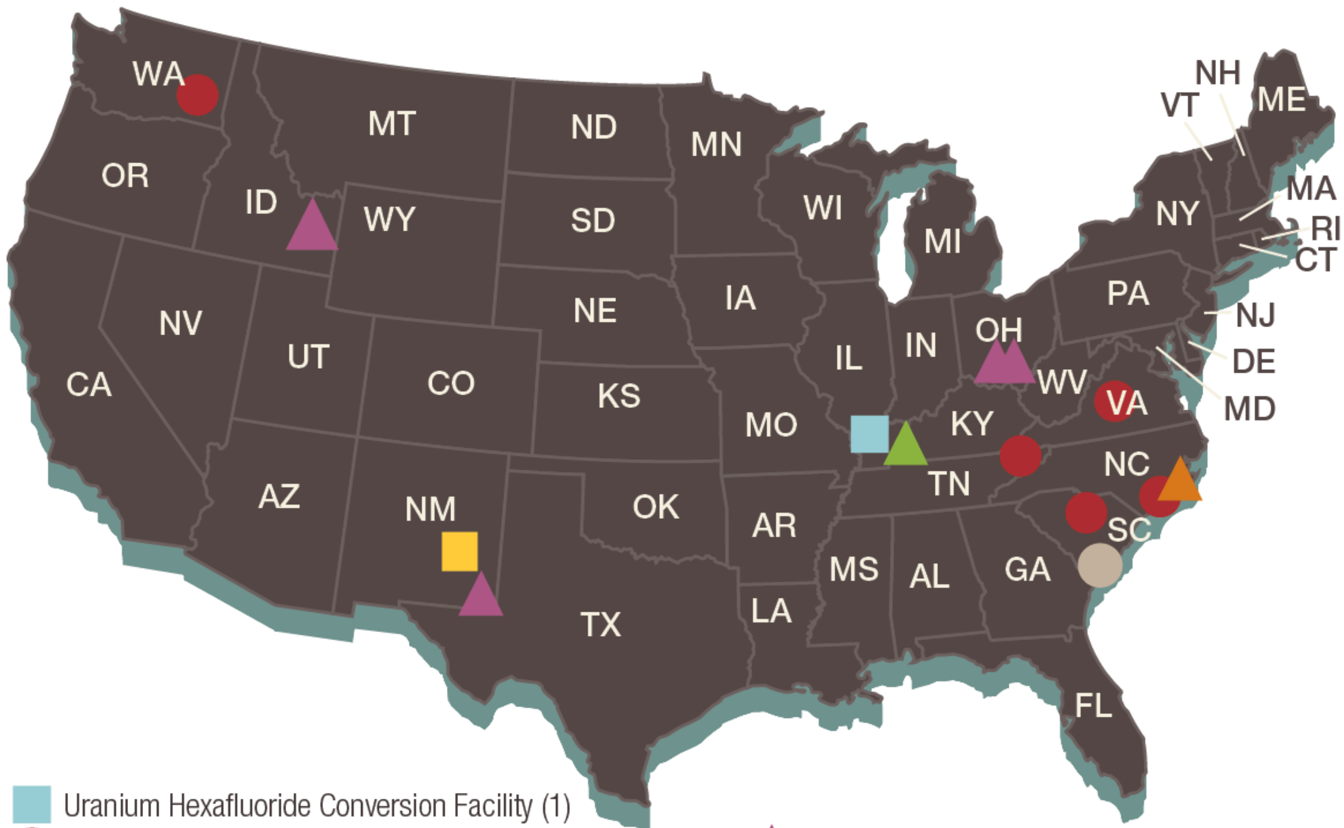
Injection wells (1) pump a chemical solution—typically ground water mixed with sodium bicarbonate, hydrogen peroxide, and oxygen—into the layer of earth containing uranium ore. The solution dissolves the uranium from the deposit in the ground and is then pumped back to the surface through recovery wells (2) and sent to the processing plant to be processed into uranium yellowcake. Monitoring wells (3) are checked regularly to ensure that uranium and chemicals are not escaping from the drilling area.

Locations of NRC-Licensed Uranium Recovery Facility Sites



States with authority to license uranium recovery facility sites
States where the NRC has retained authority to license uranium recovery facilities
NRC-licensed uranium recovery facility sites (21)

Locations of Fuel Cycle Facilities

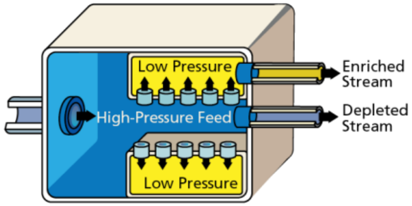


- Uranium Hexafluoride Conversion Facility (1)
- Uranium Fuel Fabrication Facility (5)
- Mixed Oxide Fuel Fabrication Facility (1)
- Gaseous Diffusion Uranium Enrichment Facility (1)
- Gas Centrifuge Uranium Enrichment Facility (4)
- Laser Separation Enrichment Facility (1)
- Uranium Hexafluoride Deconversion Facility (1)

Note: There are no fuel cycle facilities in Alaska or Hawaii.

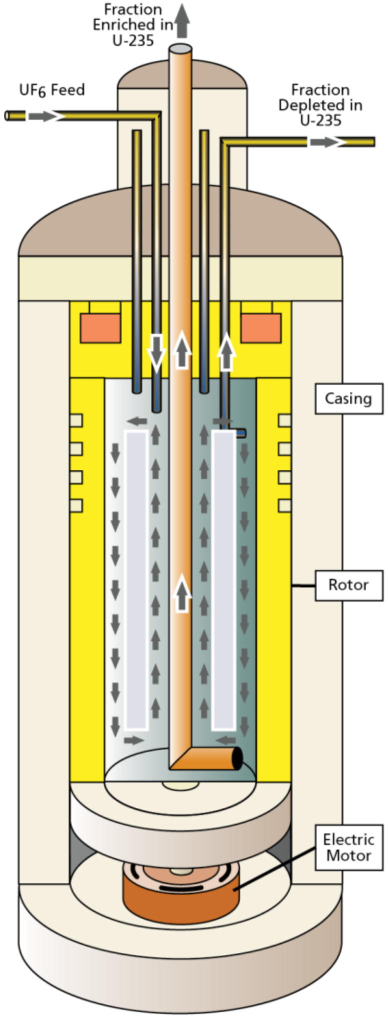
Enrichment Processes

A. Gaseous Diffusion Process



A. *The gaseous diffusion process uses molecular diffusion to separate a gas from a two-gas mixture. The isotopic separation is accomplished by diffusing uranium, which has been combined with fluorine to form UF_6 gas, through a porous membrane (barrier) and using the different molecular velocities of the two isotopes to achieve separation.*

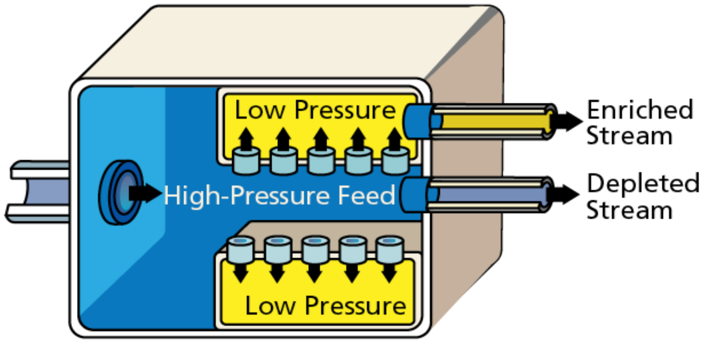
B. Gas Centrifuge Process



B. *The gas centrifuge process uses a large number of rotating cylinders in series and parallel configurations. Gas is introduced and rotated at high speed, concentrating the component of higher molecular weight toward the outer wall of the cylinder and the component of lower molecular weight toward the center. The enriched and the depleted gases are removed by scoops.*

Enrichment Processes

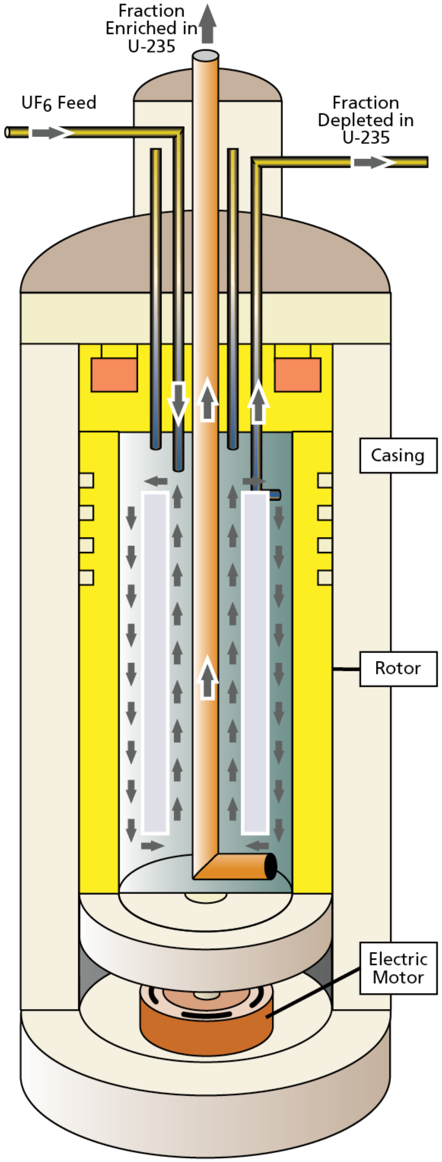
A. Gaseous Diffusion Process



A. *The gaseous diffusion process uses molecular diffusion to separate a gas from a two-gas mixture. The isotopic separation is accomplished by diffusing uranium, which has been combined with fluorine to form* UF_6 *gas, through a porous membrane (barrier) and using the different molecular velocities of the two isotopes to achieve separation.*

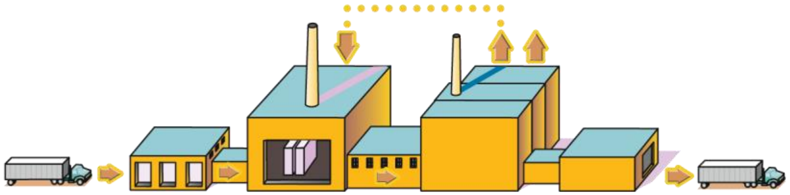
Enrichment Processes

B. Gas Centrifuge Process



B. *The gas centrifuge process uses a large number of rotating cylinders in series and parallel configurations. Gas is introduced and rotated at high speed, concentrating the component of higher molecular weight toward the outer wall of the cylinder and the component of lower molecular weight toward the center. The enriched and the depleted gases are removed by scoops.*

Simplified Fuel Fabrication Process



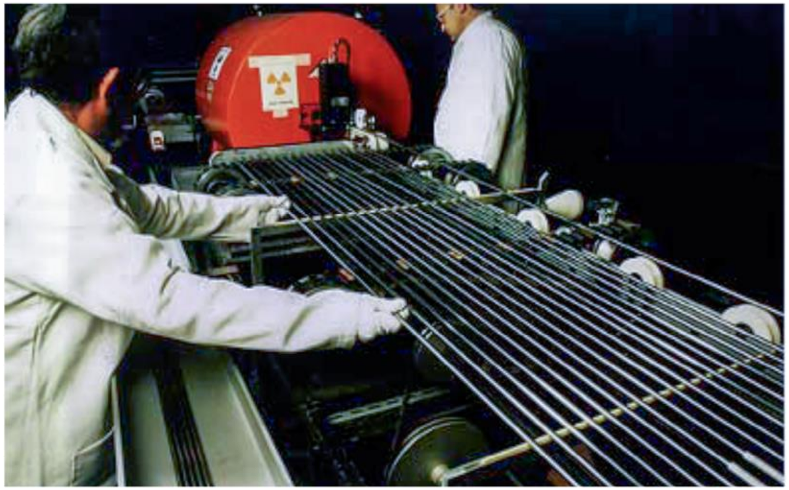
Fabrication of commercial light-water reactor fuel consists of the following three basic steps:

(1) the chemical conversion of UF_6 to UO_2 powder

(2) a ceramic process that converts UO_2 powder to small ceramic pellets

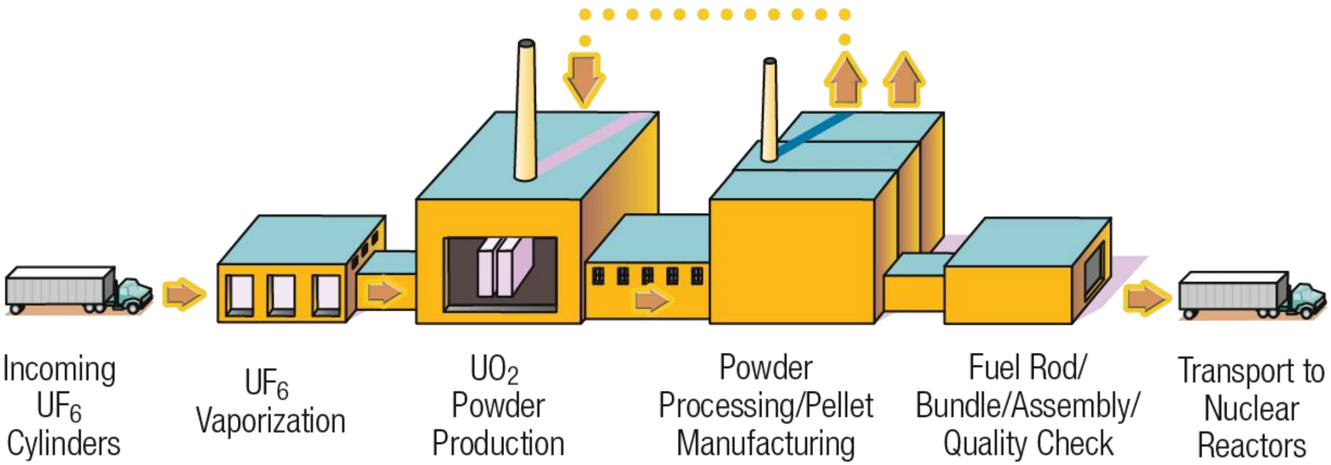
(3) a mechanical process that loads the fuel pellets into rods and constructs finished fuel assemblies

Worker displays a small ceramic fuel pellet.



Workers assemble fuel pellets into fuel rods.

Simplified Fuel Fabrication Process

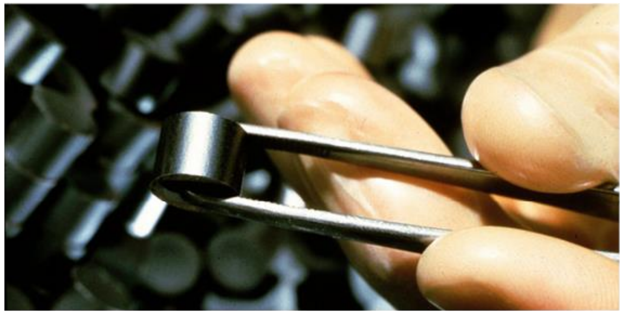


Fabrication of commercial light-water reactor fuel consists of the following three basic steps:

(1) the chemical conversion of UF_6 to UO_2 powder

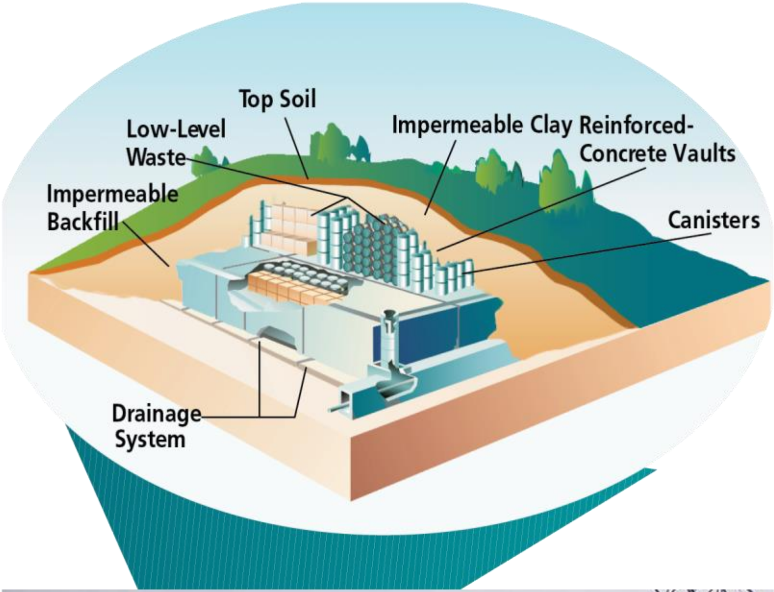
(2) a ceramic process that converts UO_2 powder to small ceramic pellets

(3) a mechanical process that loads the fuel pellets into rods and constructs finished fuel assemblies



Worker displays a small ceramic fuel pellet.

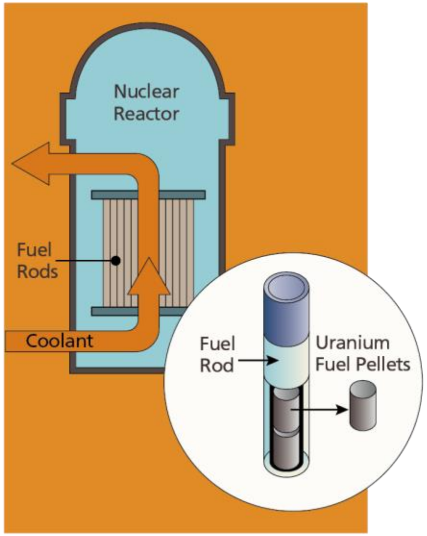
Low-Level Waste Disposal

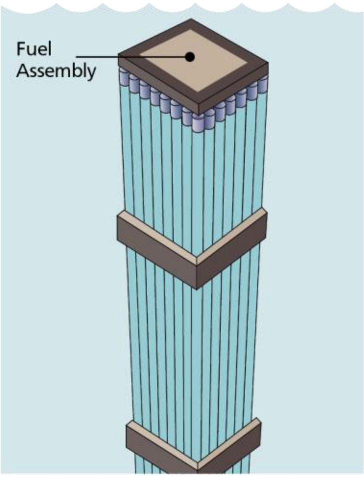


This LLW disposal site accepts waste from States participating in a regional disposal agreement.

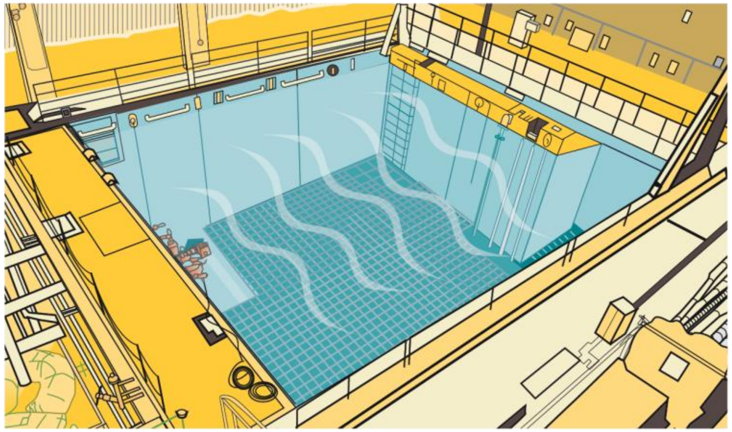
Spent Fuel Generation and Storage after Use

1 A nuclear reactor is powered by enriched uranium-235 fuel. Fission (splitting of atoms) generates heat, which produces steam that turns turbines to produce electricity. A reactor rated at several hundred megawatts may contain 100 or more tons of fuel in the form of bullet-sized pellets loaded into long metal rods that are bundled together into fuel assemblies. Pressurized-water reactors (PWRs) contain between 150 and 200 fuel assemblies. Boiling-water reactors (BWRs) contain between 370 and 800 fuel assemblies.

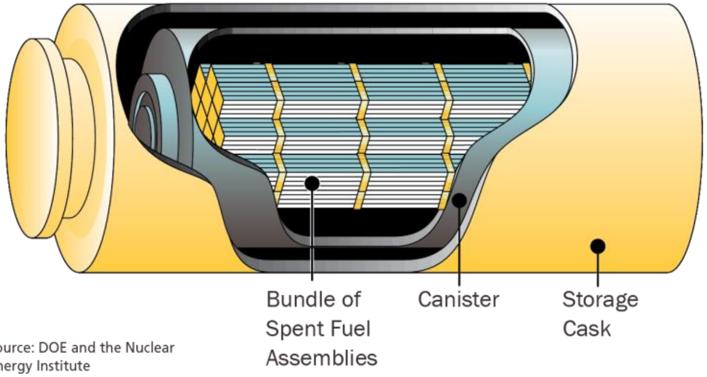




2 After 5–6 years, spent fuel assemblies—typically 14 feet (4.3 meters) long and containing nearly 200 fuel rods for PWRs and 80–100 fuel rods for BWRs—are removed from the reactor and allowed to cool in storage pools for a few years. At this point, the 900-pound (409-kilogram) assemblies contain only about one-fifth the original amount of uranium-235.



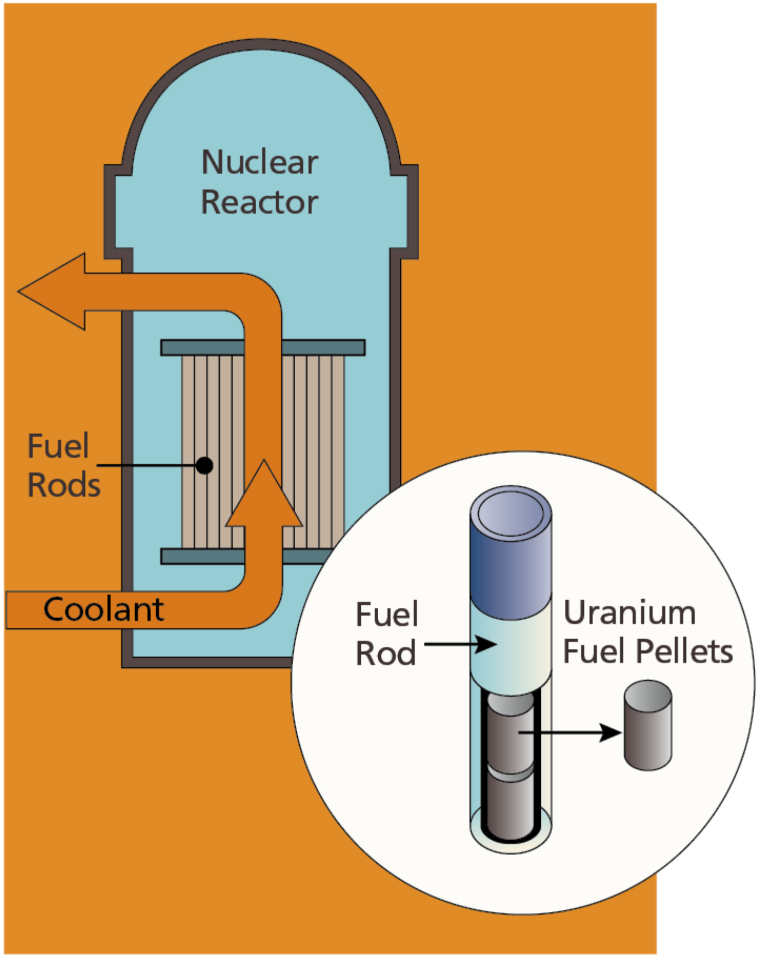
3 Commercial light-water nuclear reactors store spent radioactive fuel in a steel-lined, seismically designed concrete pool under about 40 feet (12.2 meters) of water that provides shielding from radiation. Water pumps supply continuously flowing water to cool the spent fuel. Extra water for the pool is provided by other pumps that can be powered from an onsite emergency diesel generator. Support features, such as water-level monitors and radiation detectors, are also in the pool. Spent fuel is stored in the pool until it can be transferred to dry casks onsite (as shown in Figure 42) or transported offsite to a high-level radioactive waste disposal site.



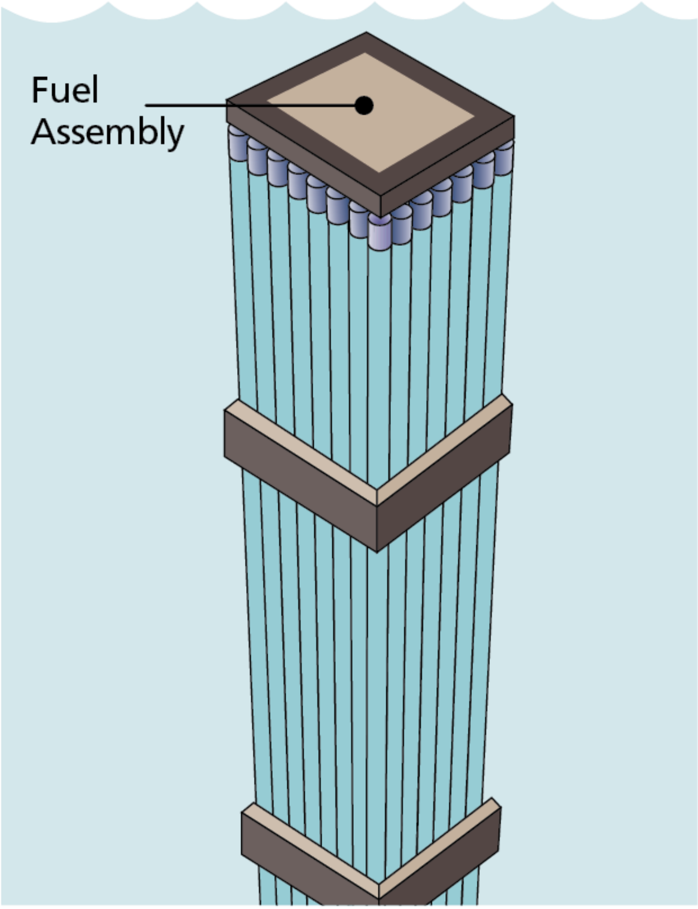
Source: DOE and the Nuclear Energy Institute

Spent Fuel Generation and Storage after Use

1 A nuclear reactor is powered by enriched uranium-235 fuel. Fission (splitting of atoms) generates heat, which produces steam that turns turbines to produce electricity. A reactor rated at several hundred megawatts may contain 100 or more tons of fuel in the form of bullet-sized pellets loaded into long metal rods that are bundled together into fuel assemblies. Pressurized-water reactors (PWRs) contain between 150 and 200 fuel assemblies. Boiling-water reactors (BWRs) contain between 370 and 800 fuel assemblies.

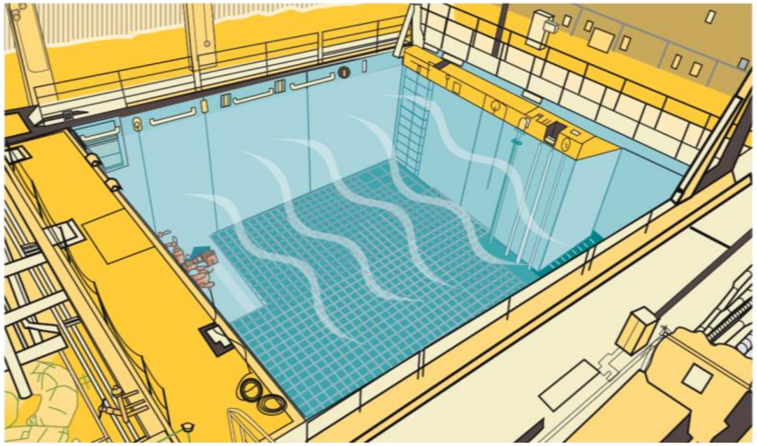


Spent Fuel Generation and Storage after Use

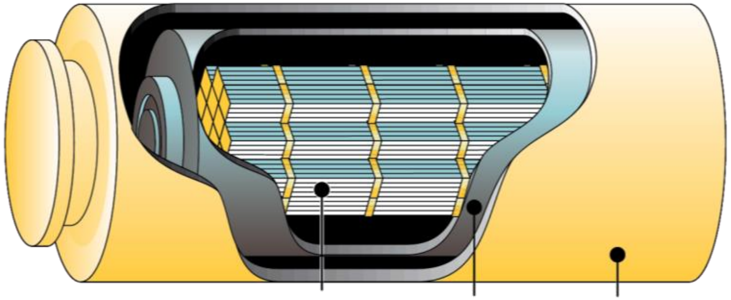


2 After 5–6 years, spent fuel assemblies—typically 14 feet (4.3 meters) long and containing nearly 200 fuel rods for PWRs and 80–100 fuel rods for BWRs—are removed from the reactor and allowed to cool in storage pools for a few years. At this point, the 900-pound (409-kilogram) assemblies contain only about one-fifth the original amount of uranium-235.

Spent Fuel Generation and Storage after Use

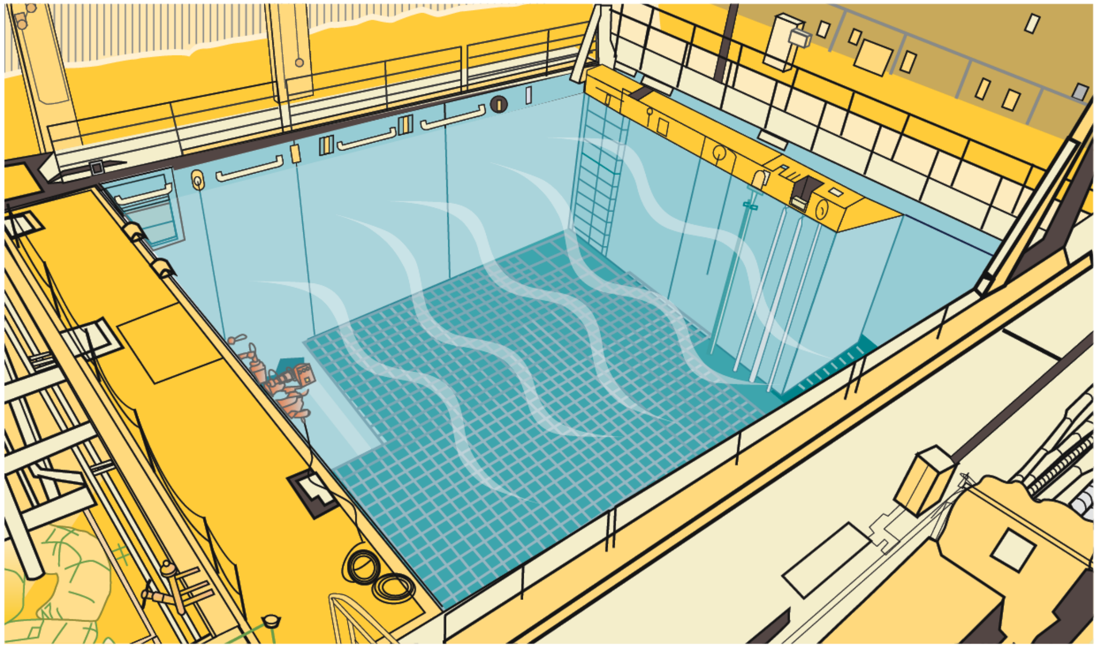


3 Commercial light-water nuclear reactors store spent radioactive fuel in a steel-lined, seismically designed concrete pool under about 40 feet (12.2 meters) of water that provides shielding from radiation. Water pumps supply continuously flowing water to cool the spent fuel. Extra water for the pool is provided by other pumps that can be powered from an onsite emergency diesel generator. Support features, such as water-level monitors and radiation detectors, are also in the pool. Spent fuel is stored in the pool until it can be transferred to dry casks onsite (as shown in Figure 42) or transported offsite to a high-level radioactive waste disposal site.



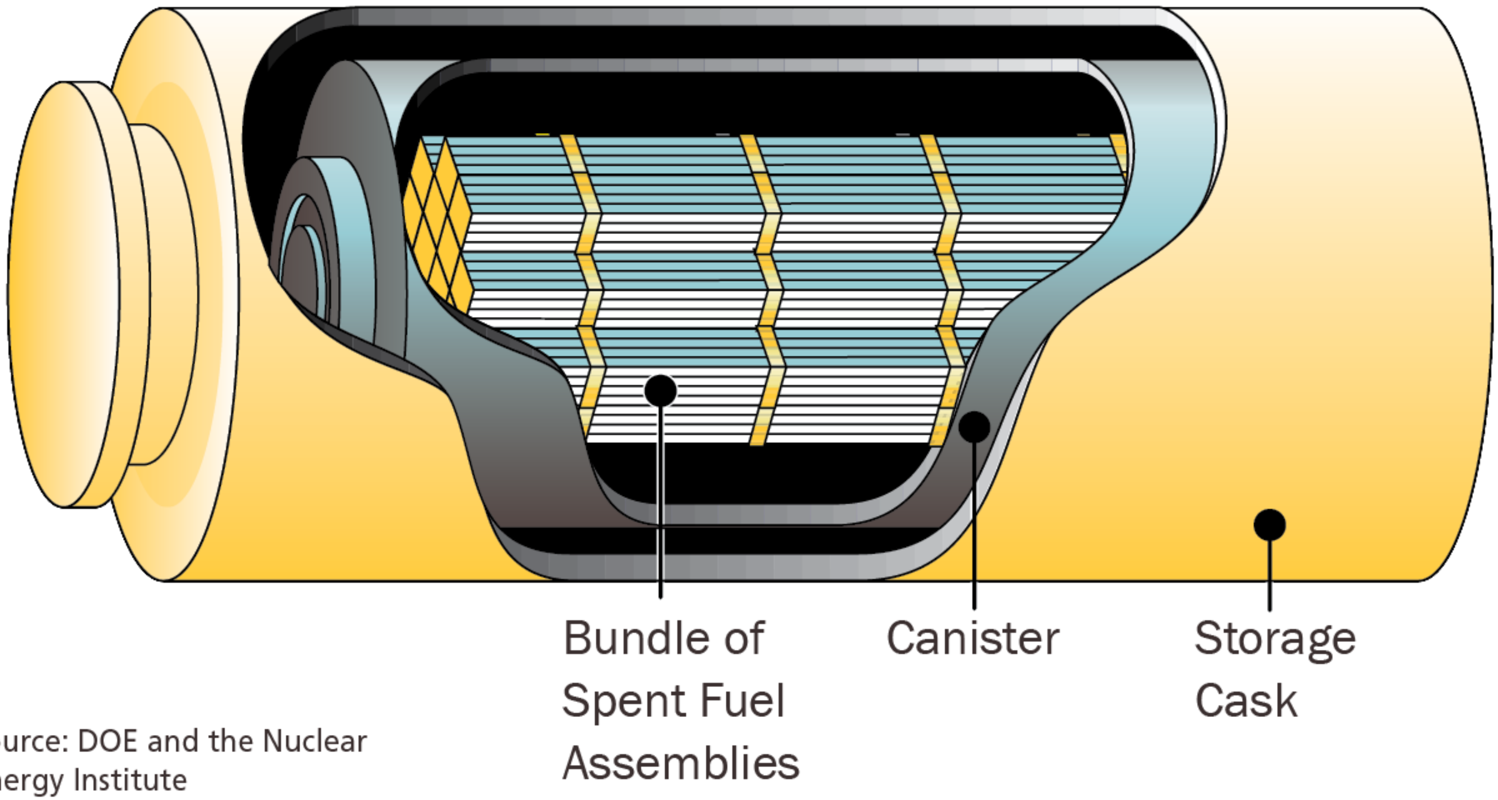
Source: DOE and the Nuclear Energy Institute

Spent Fuel Generation and Storage after Use



3 Commercial light-water nuclear reactors store spent radioactive fuel in a steel-lined, seismically designed concrete pool under about 40 feet (12.2 meters) of water that provides shielding from radiation. Water pumps supply continuously flowing water to cool the spent fuel. Extra water for the pool is provided by other pumps that can be powered from an onsite emergency diesel generator. Support features, such as water-level monitors and radiation detectors, are also in the pool. Spent fuel is stored in the pool until it can be transferred to dry casks onsite (as shown in Figure 42) or transported offsite to a high-level radioactive waste disposal site.

Spent Fuel Generation and Storage after Use

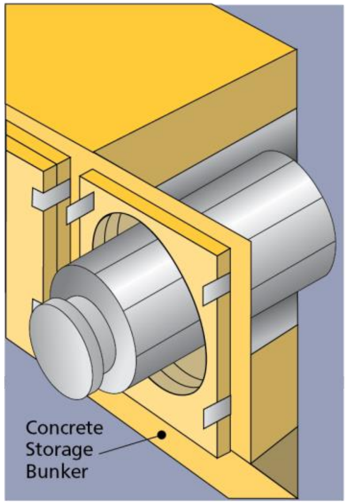


Source: DOE and the Nuclear Energy Institute

Dry Storage of Spent Nuclear Fuel

At some nuclear reactors across the country, spent fuel is kept onsite, typically above ground, in systems basically similar to the ones shown here.

1 Once the spent fuel has sufficiently cooled, it is loaded into special canisters that are designed to hold nuclear fuel assemblies. Water and air are removed. The canister is filled with inert gas, welded shut, and rigorously tested for leaks. It is then placed in a cask for storage or transportation. The NRC has approved the storage of up to 40 PWR assemblies and up to 68 BWR assemblies in each canister. The dry casks are then loaded onto concrete pads.



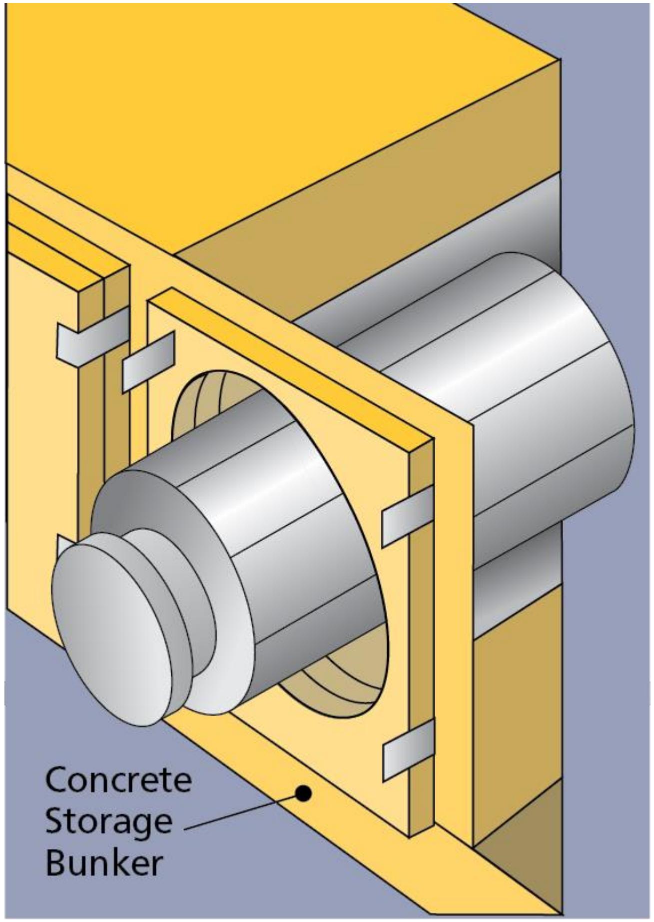
2 The canisters can also be stored in above ground concrete bunkers, each of which is about the size of a one-car garage.

Dry Storage of Spent Nuclear Fuel

At nuclear reactors across the country, spent fuel is kept onsite, typically above ground, in systems basically similar to the ones shown here. The NRC reviews and approves the designs of these spent fuel storage systems before they can be used.

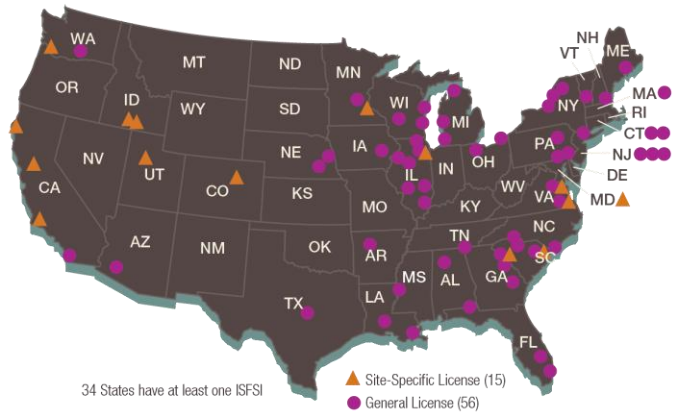
1 Once the spent fuel has sufficiently cooled, it is loaded into special canisters that are designed to hold nuclear fuel assemblies. Water and air are removed. The canister is filled with inert gas, welded shut, and rigorously tested for leaks. It is then placed in a cask for storage or transportation. The dry casks are then loaded onto concrete pads.

Dry Storage of Spent Nuclear Fuel



2 The canisters can also be stored in above ground concrete bunkers, each of which is about the size of a one-car garage.

Licensed and Operating Independent Spent Fuel Storage Installations by State



ALABAMA
- ● Browns Ferry
- ● Farley

ARIZONA
- ● Palo Verde

ARKANSAS
- ● Arkansas Nuclear

CALIFORNIA
- ▲ Diablo Canyon
- ▲ Rancho Seco
- ● San Onofre
- ▲ Humboldt Bay

COLORADO
- ▲ Fort St. Vrain

CONNECTICUT
- ● Haddam Neck
- ● Millstone

FLORIDA
- ● St. Lucie
- ● Turkey Point

GEORGIA
- ● Hatch
- ● Vogtle

IDAHO
- ▲ DOE: TMI-2 (Fuel Debris)
- ▲ Idaho Spent Fuel Facility

ILLINOIS
- ● Braidwood
- ● Byron
- ▲ GE Morris (Wet)
- ● Dresden
- ● La Salle
- ● Quad Cities
- ● Zion

IOWA
- ● Duane Arnold

LOUISIANA
- ● River Bend
- ● Waterford

MAINE
- ● Maine Yankee

MARYLAND
- ▲ Calvert Cliffs

MASSACHUSETTS
- ● Yankee Rowe

MICHIGAN
- ● Big Rock Point
- ● Palisades
- ● Cook

MINNESOTA
- ● Monticello
- ▲ Prairie Island

MISSISSIPPI
- ● Grand Gulf

NEBRASKA
- ● Cooper
- ● Ft. Calhoun

NEW HAMPSHIRE
- ● Seabrook

NEW JERSEY
- ● Hope Creek
- ● Salem
- ● Oyster Creek

NEW YORK
- ● Indian Point
- ● FitzPatrick
- ● Ginna
- ● Nine Mile Point

NORTH CAROLINA
- ● Brunswick
- ● McGuire

OHIO
- ● Davis-Besse
- ● Perry

OREGON
- ▲ Trojan

PENNSYLVANIA
- ● Limerick
- ● Susquehanna
- ● Peach Bottom

SOUTH CAROLINA
- ●▲ Oconee
- ●▲ Robinson
- ● Catawba

TENNESSEE
- ● Sequoyah

TEXAS
- ● Comanche Peak

UTAH
- ▲ Private Fuel Storage

VERMONT
- ● Vermont Yankee

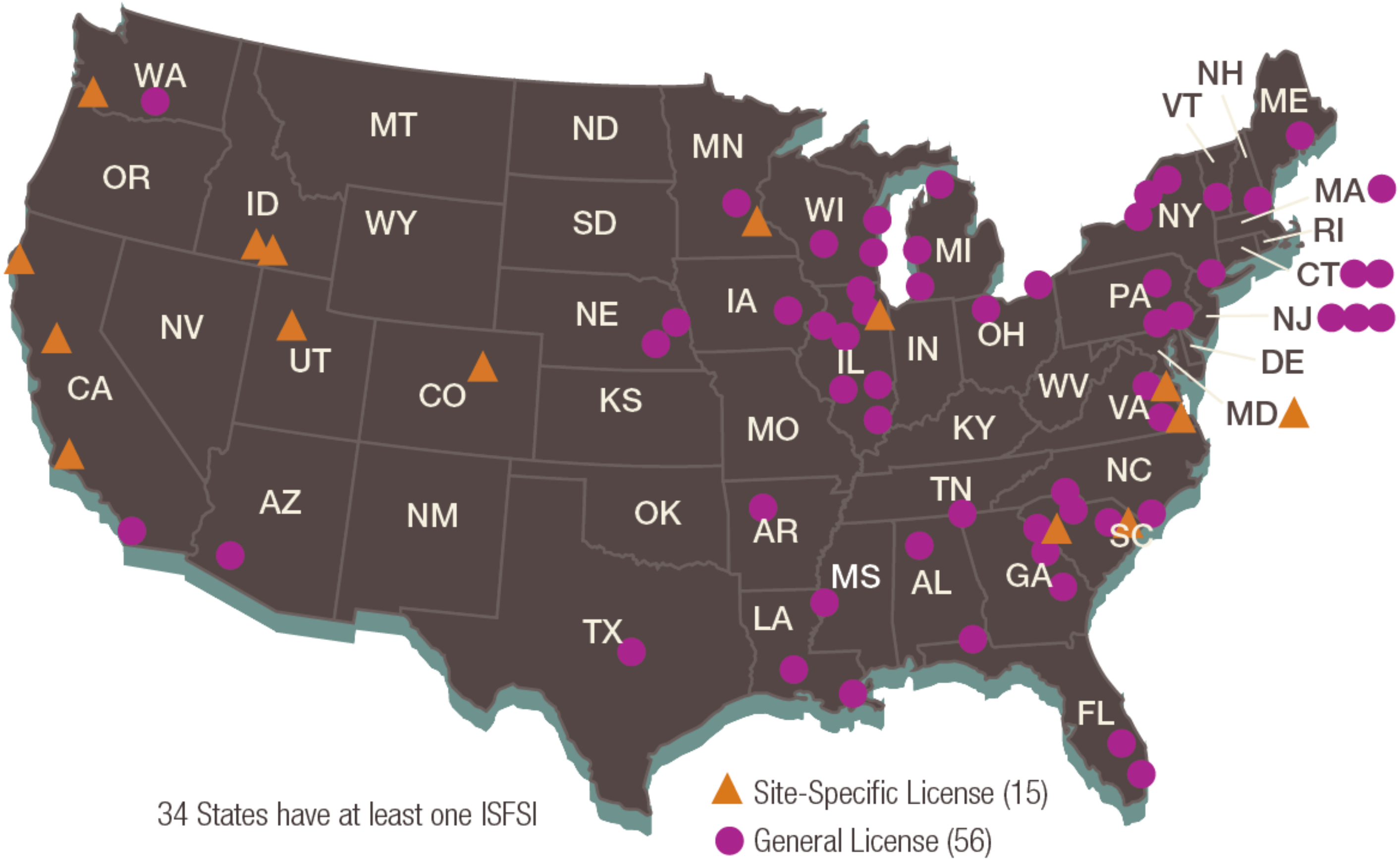
VIRGINIA
- ●▲ Surry
- ●▲ North Anna

WASHINGTON
- ● Columbia

WISCONSIN
- ● Point Beach
- ● Kewaunee
- ● LaCrosse

Data as of June 1, 2014

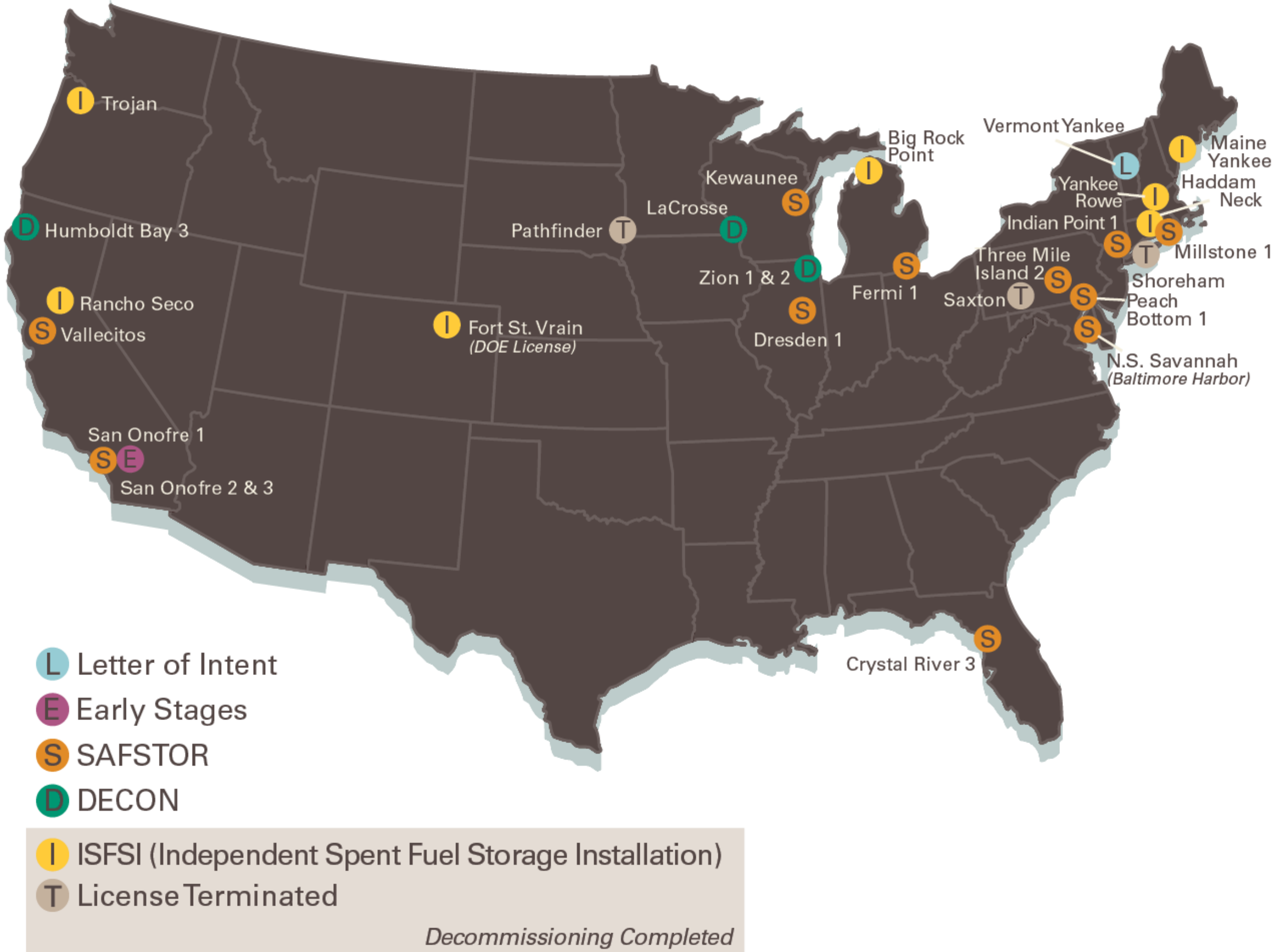
Licensed and Operating Independent Spent Fuel Storage Installations by State



Ensuring Safe Spent Fuel Shipping Containers

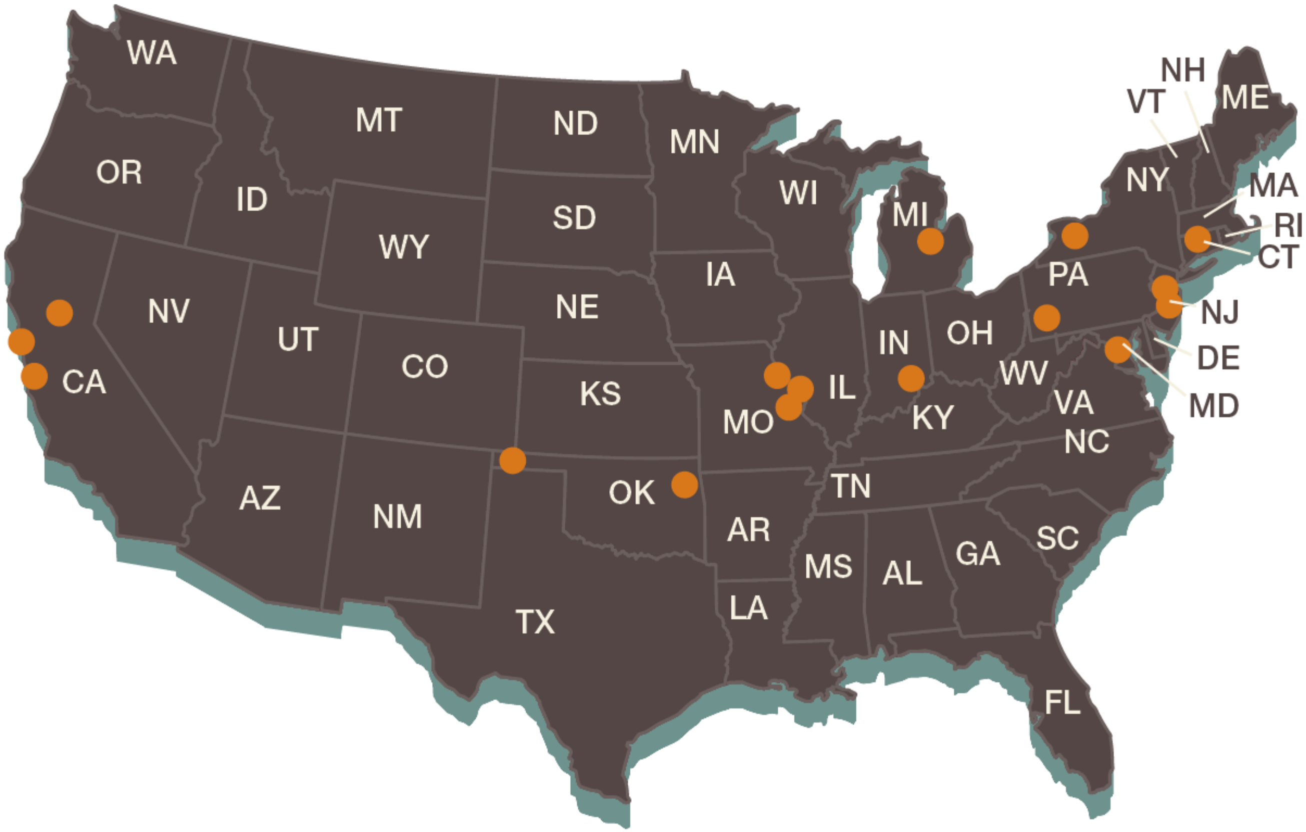
The impact (free drop and puncture), fire, and water immersion tests are considered in sequence to determine their cumulative effects on a given package.

Power Reactors Decommissioning Status



Notes: GE Bonus, CVTR, Elk River, Hallam, Piqua, and Shippingport are part of the DOE legacy reactors.
For more information contact DOE/NNSA at www.doe.nnsa.gov.

Locations of NRC-Regulated Complex Material Sites Undergoing Decommissioning



● NRC-regulated complex material sites (16)

Facilities Undergoing Decommissioning under NRC Jurisdiction

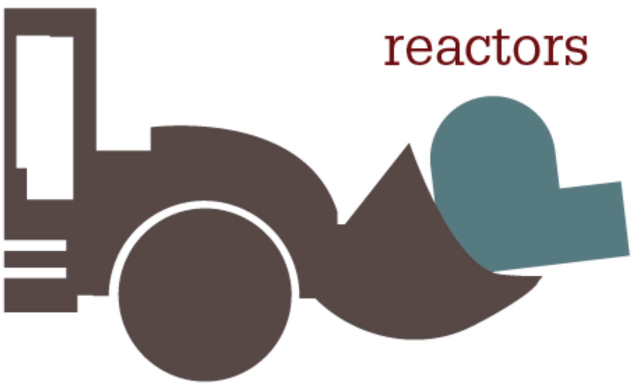
17 nuclear reactors

16 complex material sites

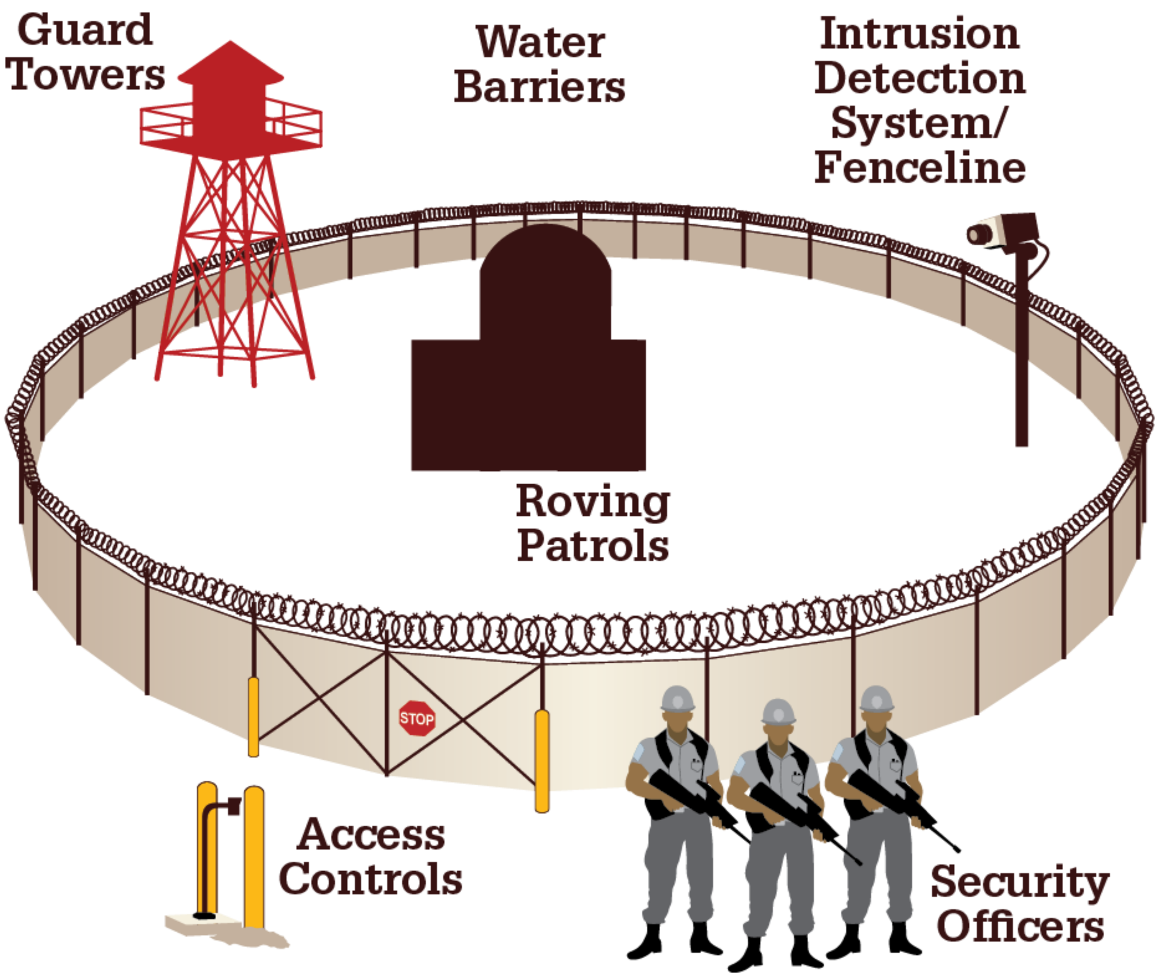
8 research and test reactors

2 fuel cycle facilities

11 uranium recovery facilities



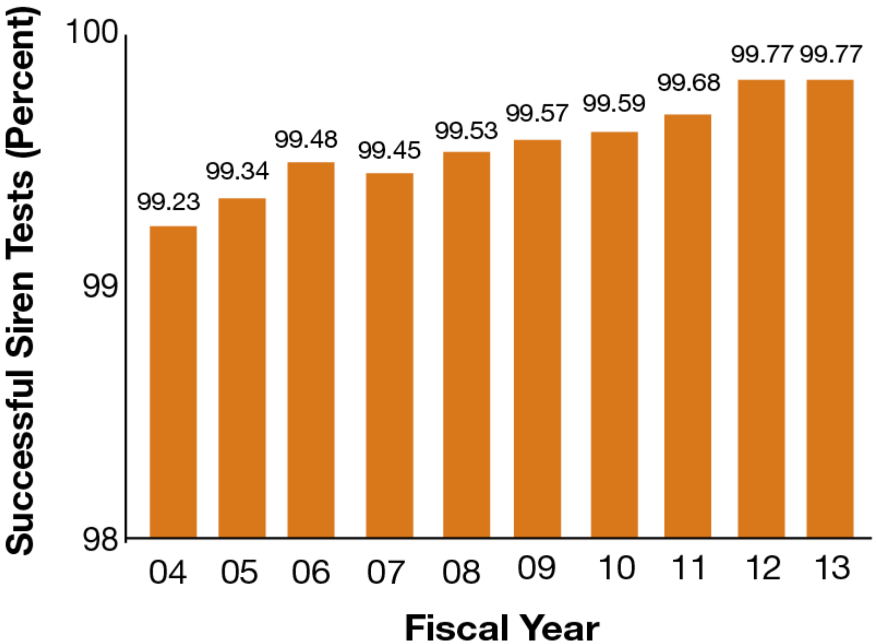
Security Components



Protecting nuclear facilities requires all of the security features to come together and work as one.

Industry Performance Indicators: Industry Averages, FYs 2004–2013

Alert and Notification System (ANS) Reliability

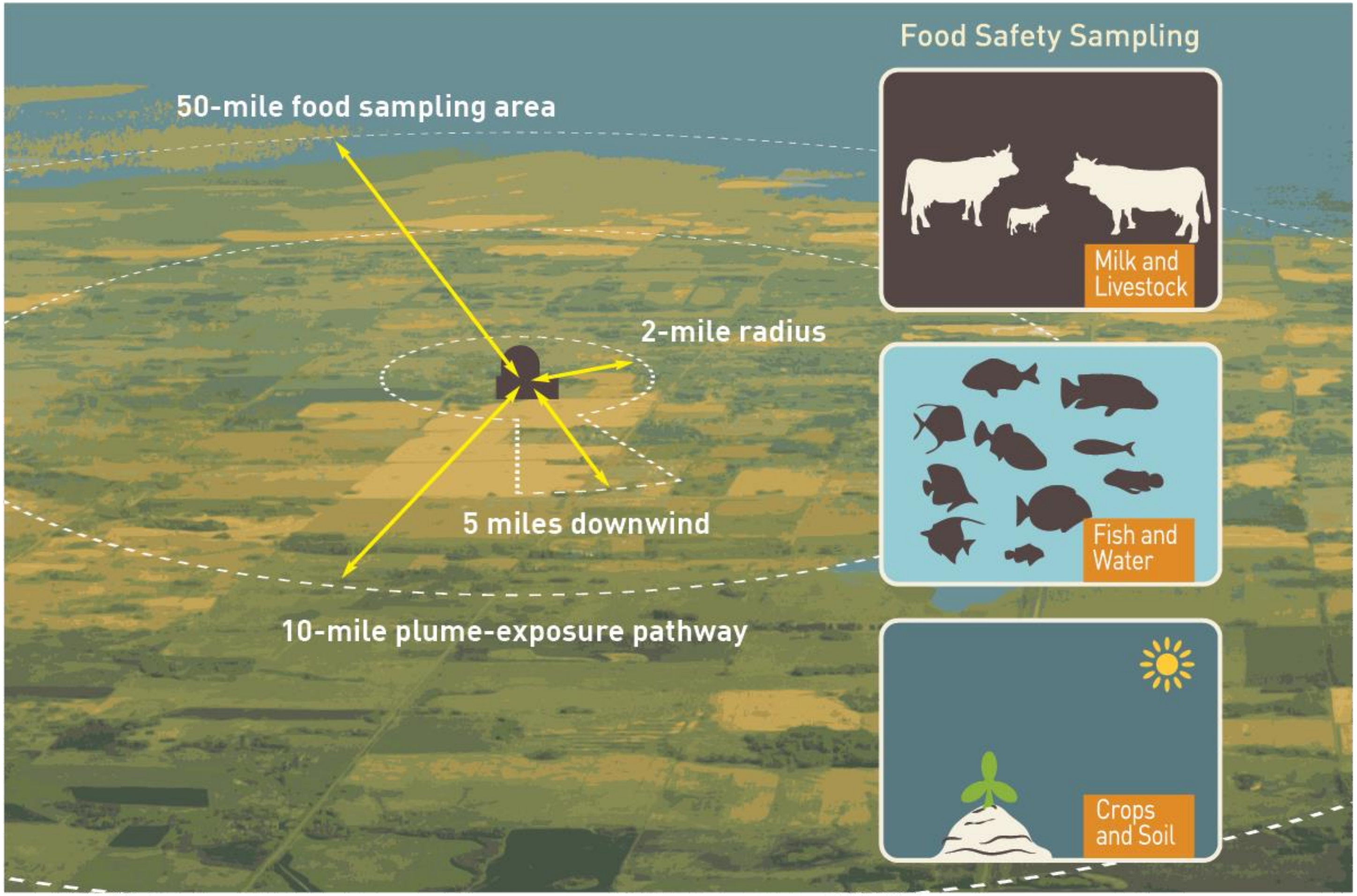


This figure shows the percentage of ANS sirens that successfully operated during periodic tests in the previous year. The result is an indicator of the reliability of the ANS to alert the public in an emergency.

Note: Data represents annual industry averages for operating reactors. The data is continuously updated to incorporate recent information and any subsequent changes in its analysis.

Source: Licensee data as compiled by the NRC

Emergency Planning Zones

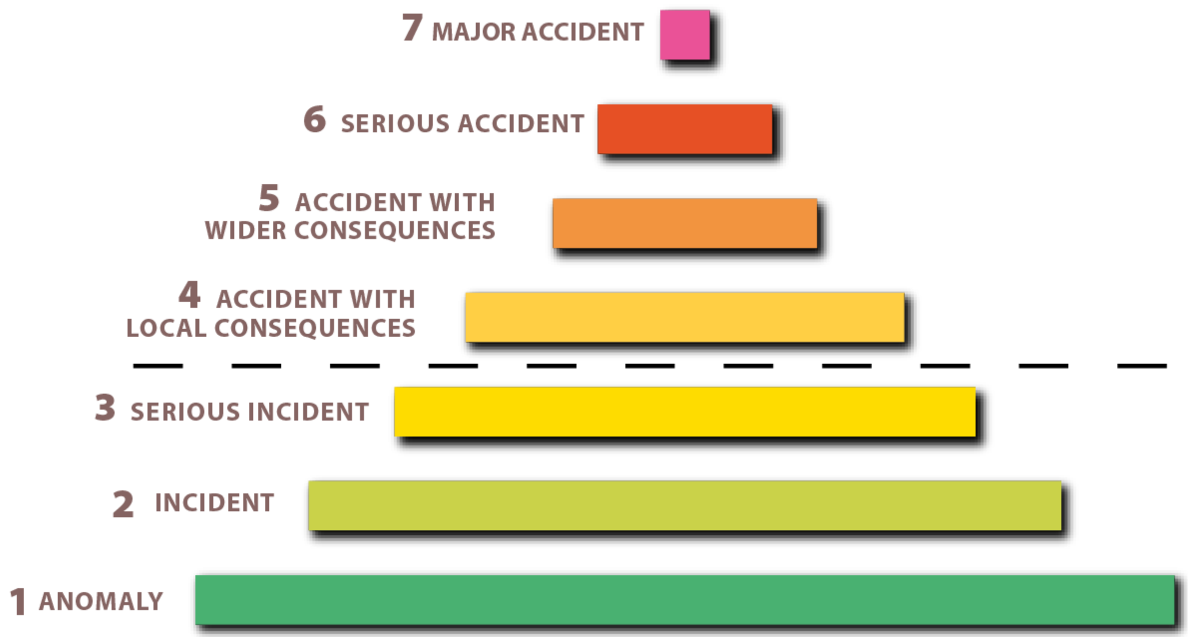


Note: A 2-mile ring around the plant is identified for evacuation, along with a 5-mile zone downwind of the projected release path.

Emergency Classifications for Nuclear Reactor Events, 2013

Classification	2013
General Emergency *Actual or Imminent Reactor Damage*	0
Site Area Emergency *Actual or Likely Plant Safety Function Failure*	0
Alert *Actual or Potential Substantial Degradation in Level of Safety*	3
Notification of Unusual Events *Potential Degradation in Level of Safety*	29

The International Nuclear and Radiological Event Scale

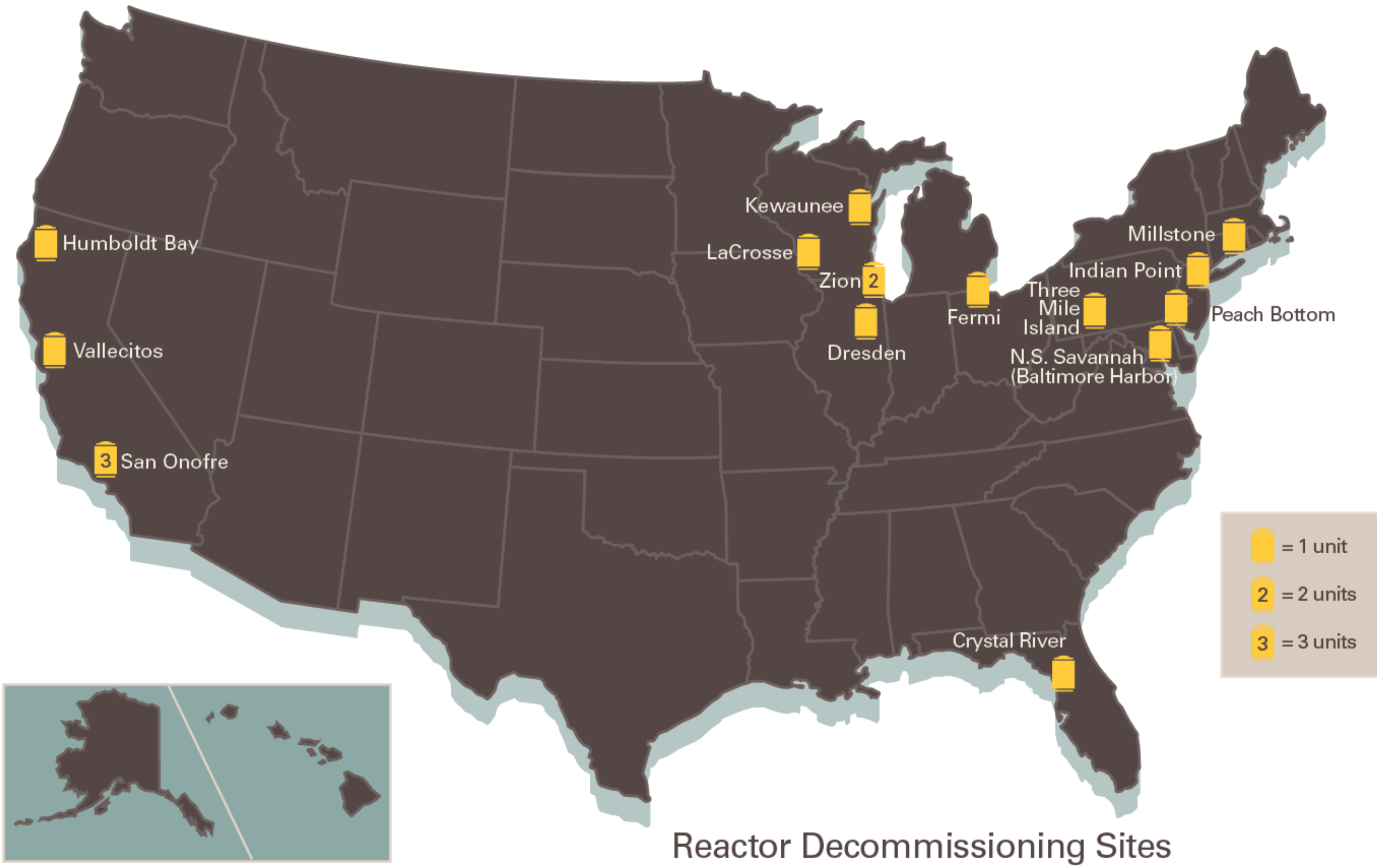


Below Scale/ Level 0

NO SAFETY SIGNIFICANCE

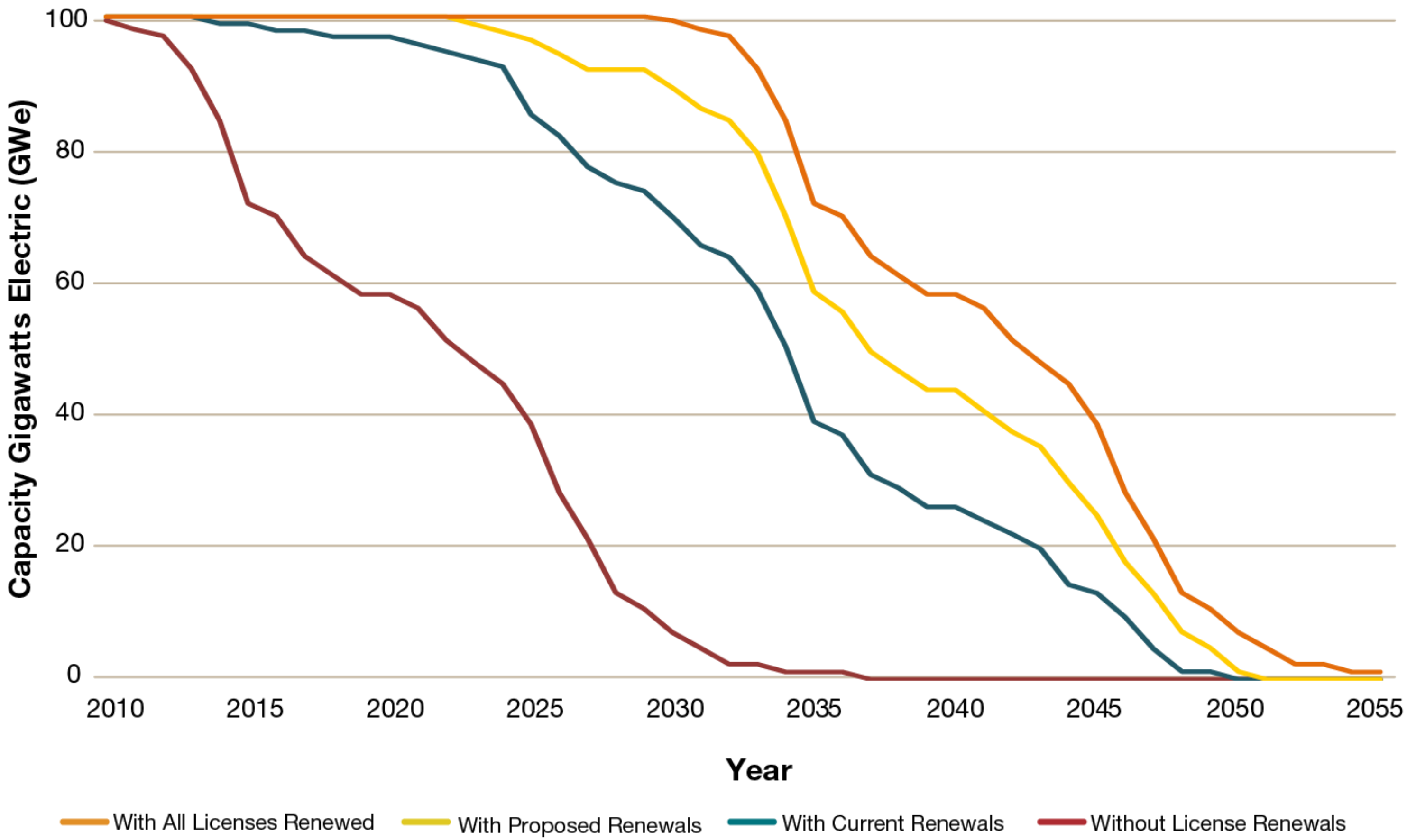
INES events are classified on the scale at 7 levels. Levels 1–3 are called "incidents" and Levels 4–7 "accidents." The scale is designed so that the severity of an event is about 10 times greater for each increase in level on the scale. Events without safety significance are called "deviations" and are classified as Below Scale or at Level 0.

U.S. Commercial Nuclear Power Reactors Undergoing Decommissioning and Permanently Shut Down Formerly Licensed To Operate



Reactor Decommissioning Sites

Projected Electric Capacity Dependent on License Renewals



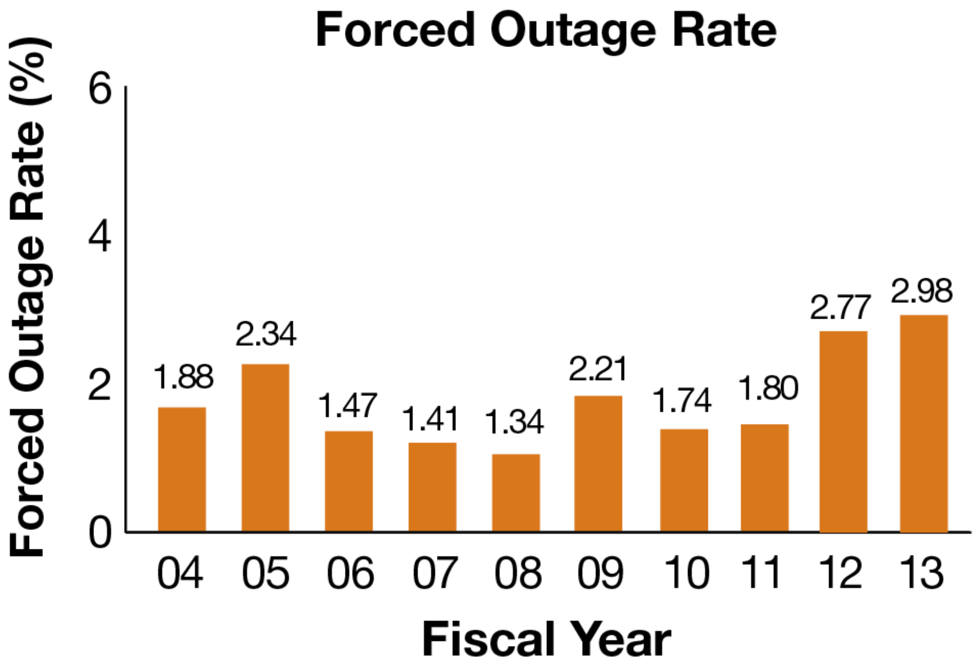
Industry Performance Indicators: Industry Averages, FYs 2004–2013

Safety system failures are any actual failures, events, or conditions that could prevent a system from performing its required safety function.

Note: Data represent annual industry averages for operating reactors. The data are continuously updated to incorporate recent information and any subsequent changes in analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

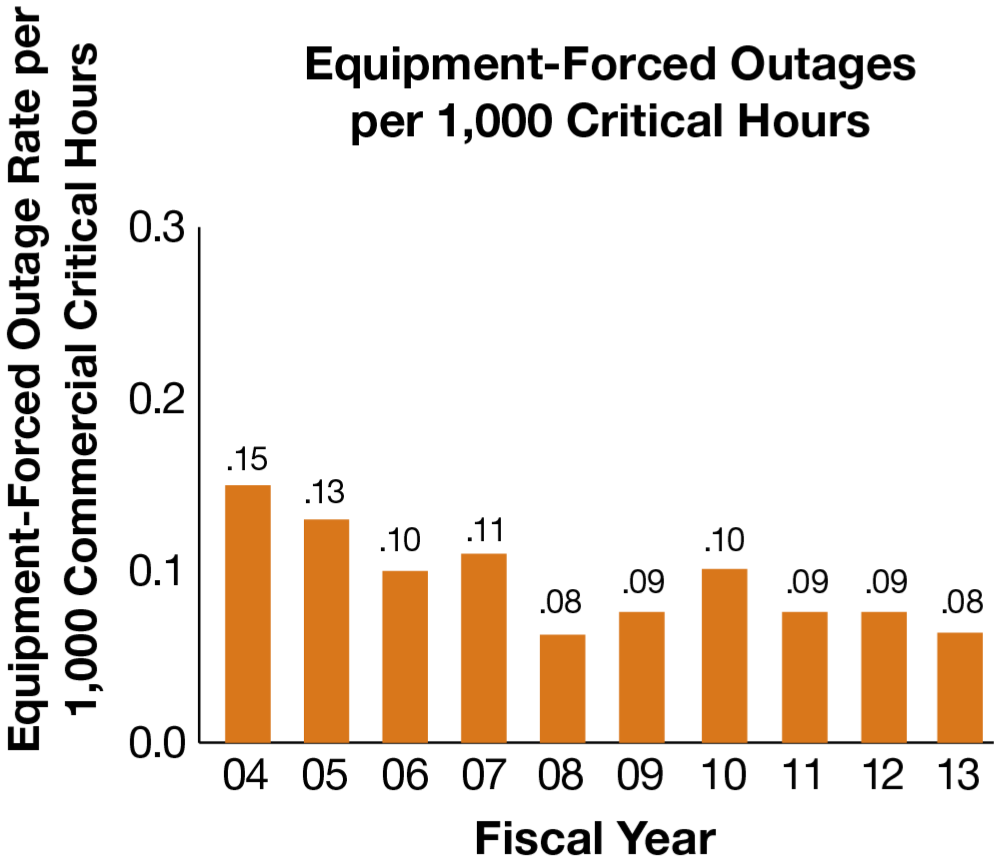


The forced outage rate is the number of hours that the plant is unable to operate (forced outage hours) divided by the sum of the hours that the plant is generating and transmitting electricity (unit service hours) and the hours that the plant is unable to operate (forced outage hours).

Note: Data represent annual industry averages for operating reactors. The data are continuously updated to incorporate recent information and any subsequent changes in analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

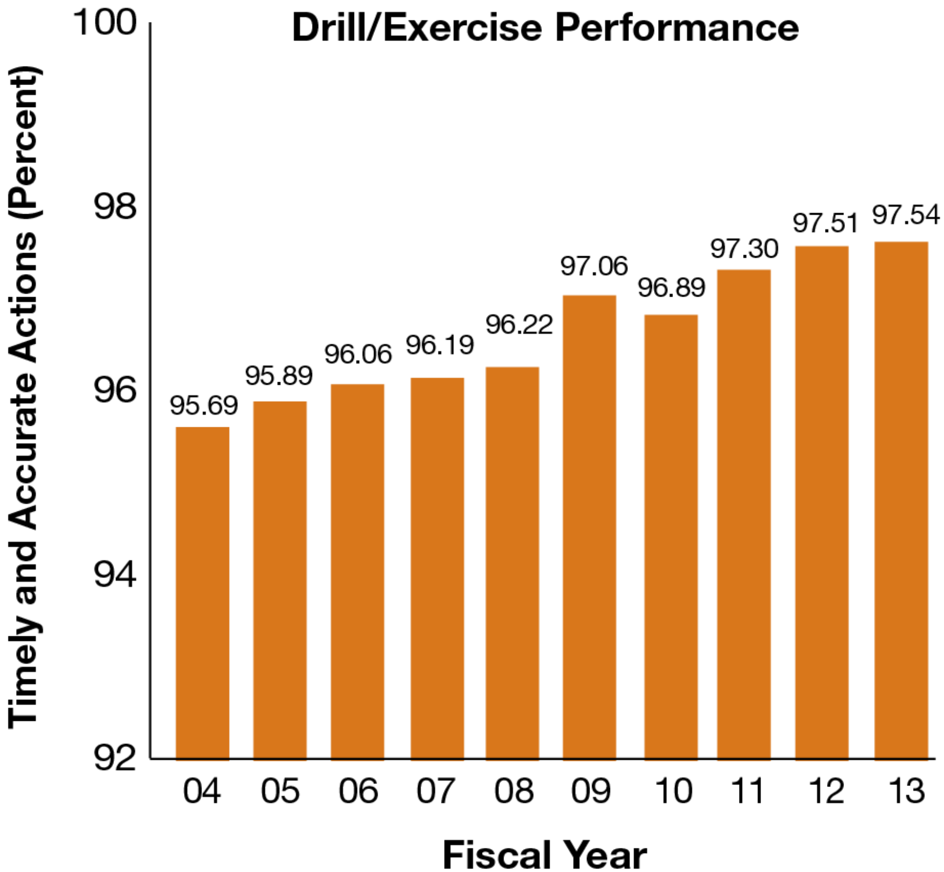


This indicator is the number of times the plant is forced to shut down because of equipment failures for every 1,000 hours that the plant is in operation and transmitting electricity.

Note: Data represent annual industry averages for operating reactors. The data are continuously updated to incorporate recent information and any subsequent changes in analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

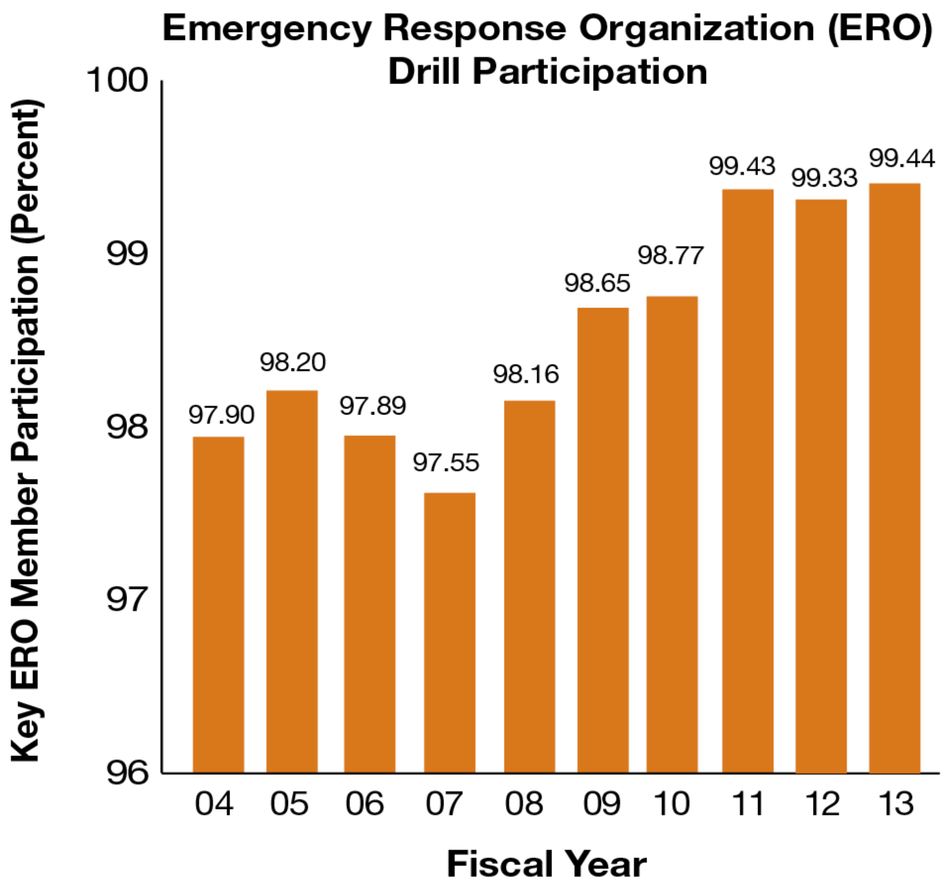


The percentage of timely and accurate actions taken by plant personnel (emergency classifications, protective action recommendations, and notification to offsite authorities) in drills and actual events during the previous 2 years.

Note: Data represent annual industry averages for operating reactors. The data are continuously updated to incorporate recent information and any subsequent changes in analysis.

Source: Licensee data as compiled by the NRC

Industry Performance Indicators: Industry Averages, FYs 2004–2013

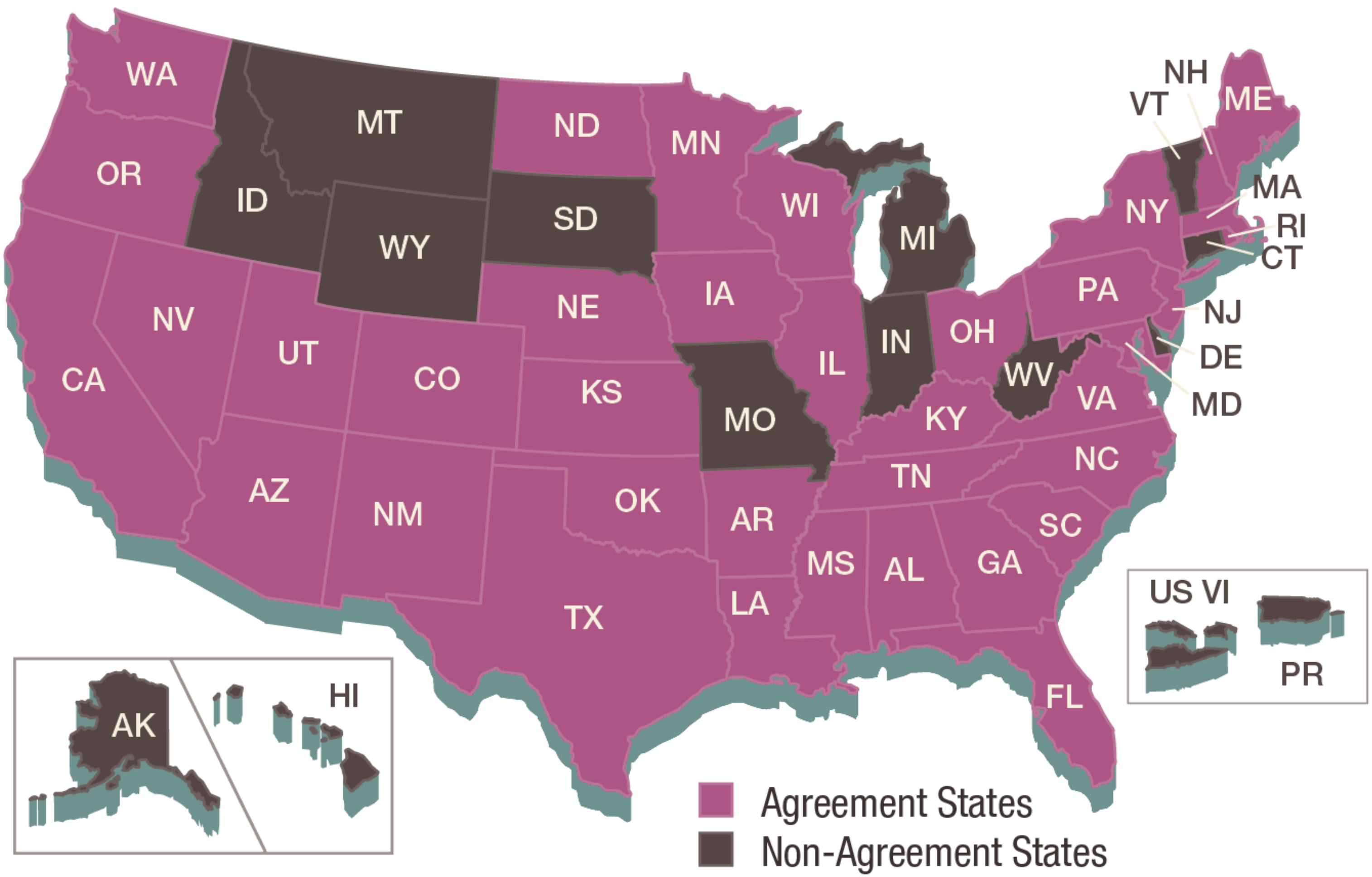


The percentage of participation by key plant personnel in drills or actual events in the previous 2 years, indicating proficiency and readiness to respond to emergencies.

Note: Data represent annual industry averages for operating reactors. The data are continuously updated to incorporate recent information and any subsequent changes in analysis.

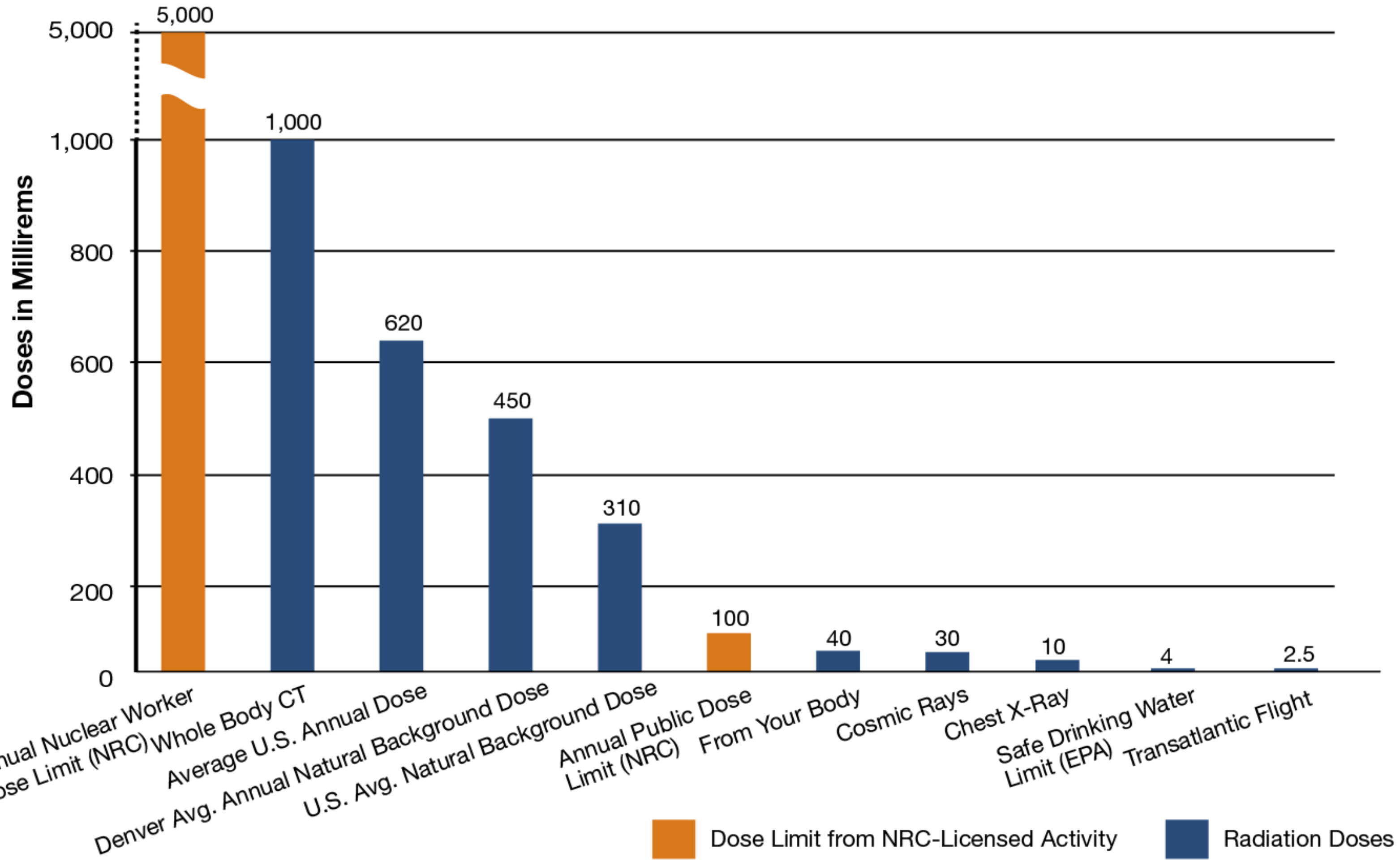
Source: Licensee data as compiled by the NRC

Agreement States



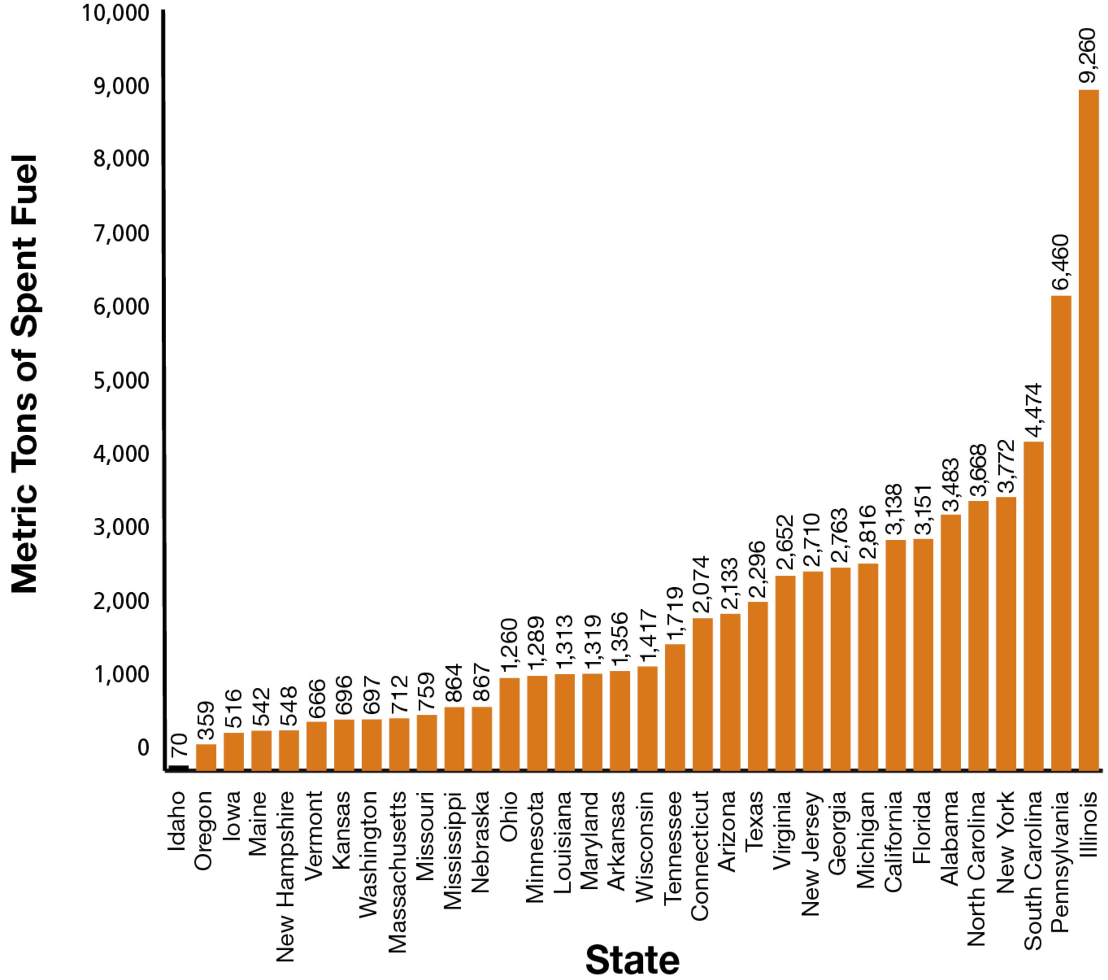
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Radiation Doses and Regulatory Limits



United States Nuclear Regulatory Commission
Protecting People and the Environment

Storage of Commercial Spent Fuel by State through 2013

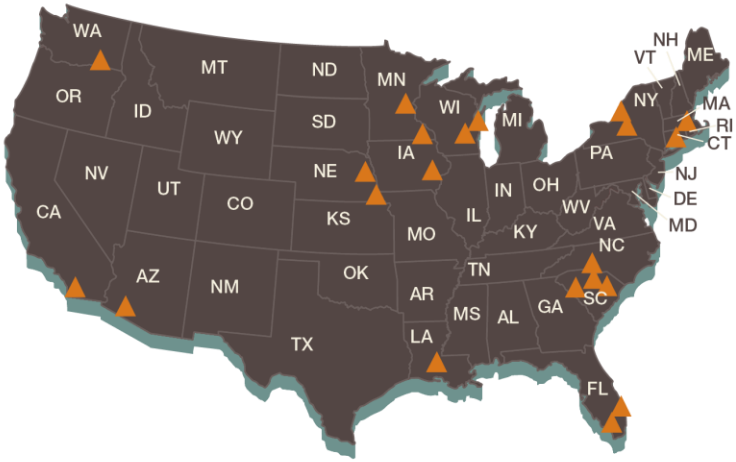


Idaho is holding used fuel from Three Mile Island 2. The used fuel data are rounded up to the nearest 10 for CY 2013.

Source: U.S. Department of Energy at Oak Ridge National Laboratory.

Updated: April 2014.

Native American Reservations and Trust Lands within a 50-Mile Radius of a Nuclear Power Plant



ARIZONA
- **Palo Verde**
  - Ak-Chin Indian Community
  - Tohono O'odham Trust Land
  - Gila River Reservation
  - Maricopa Reserve

CALIFORNIA
- **San Onofre***
  - Pechanga Reservation of Luiseño Indians
  - Pala Reservation
  - Pauma & Yuima Reserve
  - Rincon Reservation
  - San Pasqual Reservation
  - La Jolla Reservation
  - Cahuilla Reservation
  - Soboba Reservation
  - Santa Ysabel
  - Mesa Grande Reservation
  - Barona Reservation

CONNECTICUT
- **Millstone**
  - Mohegan Reservation
  - Mashantucket Pequot Reservation
  - Narragansett Reservation

FLORIDA
- **St. Lucie**
  - Brighton Reservation (Seminole Tribes of Florida)
  - Fort Pierce Reservation
- **Turkey Point**
  - Miccosukee Reservation
  - Hollywood Reservation (Seminole Tribes of Florida)

IOWA
- **Duane Arnold**
  - Sac & Fox Trust Land
  - Sac & Fox Reserve

LOUISIANA
- **River Bend**
  - Tunica-Biloxi Reservation

MASSACHUSETTS
- **Pilgrim**
  - Wampanoag Tribe of Gay Head (Aquinnah) Trust Land

MINNESOTA
- **Monticello**
  - Shakopee Community
  - Shakopee Trust Land
  - Mille Lacs Reservation
- **Prairie Island**
  - Prairie Island Community†
  - Prairie Island Trust Land†
  - Shakopee Community
  - Shakopee Trust Land

NEBRASKA
- **Cooper**
  - Sac & Fox Trust Land
  - Sac & Fox Reservation
  - Kickapoo
- **Fort Calhoun**
  - Winnebago Trust Land
  - Omaha Reservation
  - Winnebago Reservation

NEW YORK
- **FitzPatrick**
  - Onondaga Reservation
  - Oneida Reservation
- **Nine Mile Point**
  - Onondaga Reservation
  - Oneida Reservation

NORTH CAROLINA
- **McGuire**
  - Catawba Reservation

SOUTH CAROLINA
- **Catawba**
  - Catawba Reservation
- **Oconee**
  - Eastern Cherokee Reservation
- **Summer**
  - Catawba Reservation

WASHINGTON
- **Columbia**
  - Yakama Reservation
  - Yakama Trust

WISCONSIN
- **Kewaunee***
  - Oneida Trust Land
  - Oneida Reservation
- **Point Beach**
  - Oneida Trust Land
  - Oneida Reservation

* San Onofre and Kewaunee ceased operations.
† Tribe is located within the 10 mile emergency preparedness zone.
Note: This table uses NRC-abbreviated reactor names and Native American Reservation and Trust land names. There are no reservations and Trust lands within 50 miles of a reactor in Alaska or Hawaii. For more information on other Tribal concerns go to the NRC Web site at: www.nrc.gov/

Native American Reservations and Trust Lands within a 50-Mile Radius of a Nuclear Power Plant